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EDITORIAL

Stresses in Magnetic and Electric Fields

THIS is a subject on which there has been since the days of Maxwell, and on which there still is, a surprising lack of agreement.

When the magnetic field crosses the air-gap between an electromagnet and the piece of iron which is being attracted, it is known that the tension in the field is equal to $B^2/8\pi$ dynes per square centimetre. The greater part of this acts on the surface of the iron, but not all of it, for the magnetic field passes into the iron with the same value of B but a greatly reduced H and a greatly reduced tension. There appear to be considerable differences of opinion as to the magnitude of this tension within the iron. In section 642 of Vol. II of " Electricity and Magnetism," Clerk Maxwell considers this question and comes to the conclusion that the resulting force, in the simple case which we are considering, may be regarded as made up of two components; viz., a uniform pressure of $H^2/8\pi$ in all directions, and a tension in the direction of the field of $BH/4\pi$. This gives a resultant tension of $BH/4\pi - H^2/8\pi$ or $\left(B^2/8\pi\right)\left(\frac{2}{\mu} - \frac{1}{\mu^2}\right)$ dynes per cm² in the iron, so that if $\mu = 1000$, all but 1/500 of the air-gap force acts on the surface polarity.

The tension within the iron is not lost so far as the lifting power of the magnet is concerned, but it acts in a different way. If one pictures the flux passing through the iron from pole to pole as stretched elastic threads it is seen at once that there must be a " catapult " force on the iron.

On p. 180 of his " Principles of Electromagnetism " Moullin considers this problem and comes to a different conclusion. He says that if the intensity of surface polarity is I', then " at a point of space between the two surfaces the force on a unit pole would be $B = H + 2\pi I' + 2\pi I'$ (H is, of course, the magnetizing force inside the iron). But the force on a unit pole in one of the surfaces is less than B by the contribution from one surface. There is polarity I' per unit area, and therefore the pull on the face is

$$\begin{aligned} P &= (H + 2\pi I')\, I'A \\ &= \left\{H + 2\pi\frac{(B-H)}{4\pi}\right\}\frac{(B-H)}{4\pi}\, A \\ &= \frac{B^2 - H^2}{8\pi}\, A = \frac{B^2}{8\pi}\left(1 - \frac{1}{\mu^2}\right) A." \end{aligned}$$

Moullin attributes the fact that this is less than $B^2/8\pi$ per cm² to the neglect of leakage flux, but, as a matter of fact, the result is bigger than it should be, for it is only supposed to give the force on the surface polarity, which according to Maxwell should be

$$\left(B^2/8\pi\right)\left(1 - \frac{2}{\mu} + \frac{1}{\mu^2}\right).$$

This discrepancy is apparently due to the assumption that the force on each square centimetre of the pole-face is $I'(H + 2\pi I')$; if Maxwell is correct it is really only $2\pi I'^2$. In the gap where the unit pole is placed in a uniform field of strength equal to B the force on it will be equal to B, but as the flux enters the pole-face we must picture B splitting up into two components H and $4\pi I'$, of which the former passes through the surface into the iron and takes no part in the polar force. Hence, the force on the polar surface per cm² is not $\frac{B-H}{4\pi}\left(H+\frac{B-H}{2}\right)$ but only $\left(\frac{B-H}{4\pi}\right)\left(\frac{B-H}{2}\right)$ which is equal to $\frac{B^2}{8\pi}-\frac{BH}{4\pi}+\frac{H^2}{8\pi}$ and since the total tension per cm² is $B^2/8\pi$, the tension inside the iron is equal to the difference, viz

$$\frac{BH}{4\pi}-\frac{H^2}{8\pi}=\frac{B^2}{8\pi}\left(\frac{2}{\mu}-\frac{1}{\mu^2}\right)=\frac{BH}{8\pi}\left(2-\frac{1}{\mu}\right)$$

which is in accordance with Maxwell. On a subsequent page Moullin gives the Maxwell formula and refers to it as the correct answer.

Larmor in the analogous electric case obtained the same result as Moullin in a different manner. In the air-gap the force on unit pole would be B, whereas in the iron it would be H; if the unit pole is situated on the boundary between them, the most obvious value to take is the mean $(B+H)/2$, and since the pole strength per cm² is $(B-H)4\pi$, this gives a force per cm² of $(B^2-H^2)/8\pi$, which is the value obtained by Moullin. We should add that Larmor did not support this, but merely gave it as one of what he called the "discrepant" values.*

The problem can be approached in a different manner, which also has its pitfalls—very subtle ones—into which we have fallen in the past. If a uniformly wound toroid of permeability μ is split across a diameter and immersed in a medium also of permeability μ, then on separating the two halves, the gap is not filled with air but with the medium of the same permeability as the toroid. If we assume that the current is increased as the gap is opened so that the flux Φ is maintained constant, there will be no induced e.m.f. and no interchange of energy with the electric circuit; hence, B, H, and Φ are unchanged but the volume has been increased by $2Ag$, if A is the cross-sectional area of the ring and g the length of the gap. Since the energy per cm³ is $HB/8\pi$ we have for the pull required

$$P\times g=\frac{HB}{8\pi}\times 2Ag \text{ and } P=\frac{HB}{8\pi}\times 2A.$$

The pull per cm² is therefore

$$HB/8\pi=\frac{B^2}{8\pi}\cdot\frac{1}{\mu}$$

and, since there are no poles, this should be the tension inside the material of permeability μ. This is only half the value given by the Maxwell formula, but if $\mu=1000$, it is a thousand times the value given by Moullin's formula. In the analogous electric case Larmor also gave this as one of the "discrepant" values.

Assuming that Maxwell's formula gives the correct value we have to explain why the above way of looking at the problem gives only half the correct result. If the voltage applied to a capacitor is gradually increased from 0 to V, the energy supplied to it is $0.5QV$ or $0.5CV^2$, but if the voltage V is suddenly applied to it, so that the whole charge enters it under the full voltage V then the energy supplied to it must be QV or CV^2, that is, twice the previous value. Similarly if, instead of gradually increasing the load on a spring-balance, one applies the whole weight suddenly, twice the energy is given to the spring. In both cases the extra energy is dissipated as heat due to oscillations before the steady state is reached. Similarly if, instead of gradually building up a magnetic field by increasing the m.m.f., one applies the full value to the unmagnetized material, the energy supplied is not the $HB/8\pi$ per cm³ or the $0.5LI^2$ which is finally stored, but twice this value, the other half being dissipated. When the gap was made between the two half-rings and filled with a medium of the same permeability, we assumed that the current was increased so that the flux Φ was maintained constant; this means that the value of B in the medium in the gap was not gradually increased but instantly raised to its full value. The energy supplied to the gap was therefore twice that ultimately stored in it and the work done in separating the two half-rings was double that calculated above. This gives for the tension or pull per cm² $\frac{B^2}{8\pi}\cdot\frac{2}{\mu}$ which agrees with the Maxwell formula, except for the usually negligible term involving $1/\mu^2$.

We now proceed, however, to remove even this small discrepancy. In the case of an air capacitor suddenly connected across a battery of negligible resistance by means of wires also of negligible resistance, the initial rush of current would be limited by the inductance of the circuit, since $di/dt = V/L$ when $t = 0$; an oscillatory current would be set up, which in the absence of losses would continue indefinitely, charging and discharging the capacitor. Owing to the unavoidable losses in the battery and leads, however, the oscillation would be damped out, leaving the capacitor charged with an amount of energy $0.5CV^2$ and this is the total energy supplied to the capacitor. If the air capacitor were replaced by one with a dielectric in which losses occur then the oscillation would be damped out, even although the battery and leads were free from loss, but the energy supplied to the capacitor would then include both the stored energy and that dissipated in the dielectric. The total electrical displacement within the dielectric is made up of two components in accordance with the formula $D = \kappa_0\mathcal{E}/4\pi + P$ in which the first term represents the component which would be present even in a vacuum and the second the component due to the molecular polarization, or displacement of electrons within the dielectric molecules. We may regard the capacitor as made up of two capacitors in parallel, in the first of which the energy supplied is only that ultimately stored in it, whereas in the other the energy supplied is double that ultimately stored, the excess being dissipated as dielectric hysteresis. From this point of view the doubling of the energy would not apply to the whole capacitance but only to the polarized portion, which forms $1 - \kappa_0/\kappa$ of the whole.

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*Proc. Roy. Soc. LII (1892) p. 55.

Exactly similar considerations can be applied to the magnetic case of a uniformly wound toroid which is connected in series with a constant current source but which is normally short-circuited. On opening the short-circuit switch, the coil is suddenly called on to carry the constant current. Just as the unavoidable inductance fixed the rate at which the capacitor was charged, so here the unavoidable capacitance between the leads and turns fixes the rate at which the current through the coil, and with it the magnetic flux, increases. The initial rate of voltage rise across the coil will be given by the formula $dv/dt = I/C$. Oscillations occur as in the capacitor, and by analogous considerations it is easily seen that in the formula $B = \mu_0 H + 4\pi J$ it would only be the latter term that would involve a doubling of the stored energy to cover the losses incurred in the oscillations set up by what may be called shock excitation. Hence instead of the energy supplied to the gap in the above experiment being

$$\frac{HB}{8\pi} \times 2$$

it is

$$\frac{H^2}{8\pi} + \frac{H(B-H)}{8\pi} \times 2$$

$$= \frac{BH}{4\pi} - \frac{H^2}{8\pi} = \frac{B^2}{8\pi}\left(\frac{2}{\mu} - \frac{1}{\mu^2}\right)$$

Our experiment with the two half-rings is, of course, purely fictitious; we imagine the two half-rings made, say, of iron, and when they are separated we picture the gap being immediately filled with some imaginary medium of the same permeability magnetized instantly to the full value, since we assume a constant flux in the ring.

Analogous reasoning can be applied to the electric case. Instead of an iron ring we assume a ring of some dielectric material split across a diameter and immersed in a medium of the same dielectric constant. Instead of maintaining a magnetic flux by means of a current through the ring, we imagine an electric flux to be maintained by a changing magnetic field through the ring. If we replace H by $\mathcal{E}$ and B by $4\pi D$ we obtain for the electric tension per cm^2 along the field

$$D\mathcal{E} - \frac{\mathcal{E}^2}{8\pi} = 2\pi D^2\left(\frac{2}{\kappa} - \frac{1}{\kappa^2}\right)$$

This formula for the electric field is not given by Maxwell, but if the formula gives the correct stress in the magnetic field the parallelism is such that it must also give the correct stress in the electric field.

We would emphasize that we have not proved the correctness of Maxwell's formula, but rather, assuming its correctness, we have shown how it can be obtained from simple energy considerations if certain assumptions are made. A number of eminent physicists, including Helmholtz, have disagreed with the Maxwell formula, and maintained that the tension is simply $BH/8\pi$ and not $\frac{BH}{8\pi}\left(2 - 1/\mu\right)$. In support of this it might be pointed out that in the above imaginary experiment, although the flux density in the gap is maintained constant, the medium can only get into the gap by passing through the fringe of the field in which the flux density increases gradually from zero to the full value, thus avoiding any shock excitation.

G. W. O. H.

EFFECTIVE IMPEDANCE OF A SPHERE IN A MAGNETIC FIELD*

By T. S. E. Thomas, B.Sc., Ph.D.

SUMMARY.—A conducting sphere in a uniform magnetic field may be regarded as being equivalent to a single-turn coil of the same diameter. Formulae are given for (a) the equivalent resistance and inductance of the coil, (b) the change in inductance and resistance of a solenoid when a sphere is placed at its centre, (c) the heat dissipated in a sphere in a uniform alternating magnetic field.

Introduction

EDDY currents have an analogous position in electrical engineering to frictional losses in other branches of engineering since their effects are sometimes undesirable, sometimes useful and are always difficult to estimate. The mathematical theory of eddy-current distributions has been almost entirely concerned with problems involving either infinite cylinders or unbounded planes. In recent years the developments in induction heating and in eddy-current methods of detecting concealed metal objects have shown the need for methods of predicting the effect of eddy-currents in objects of finite size. So far the only case which has been really amenable to mathematical calculation is that of the conducting sphere in a varying magnetic field. Although numerous papers have dealt with various aspects of this problem, formulae of practical importance are only given in two papers and as some are inaccurate, it has been thought desirable to revise and extend the theory.

General Theory

The field disturbance caused by placing a conducting sphere in a uniform alternating magnetic field can be described physically in two ways :—

1. It can be regarded as being equivalent to that due to a magnetic dipole the moment of which varies harmonically and has a phase lag behind the field.

2. It can be regarded as being equivalent to that due to a single-turn coil with the same diameter as the sphere. This coil has an equivalent resistance and inductance of such magnitude that the induced current in the coil has the same magnetic field as the dipole described above. The resistance and inductance will in general be functions of the frequency.

A formula for the moment of the equivalent dipole has been given by Smythe[1] and also by Divi lkovski[2]. It is possible, starting from this result, to deduce the equivalent resistance and inductance of the sphere. The magnetic moment P of the dipole in a field $H = H_0 \cos \omega t$ is

$$P = \frac{2(\mu - 1)\, I_{1/2}(v) - (2\mu + 1) I_{5/2}(v)}{(\mu + 2) I_{1/2}(v) - (\mu - 1) I_{5/2}(v)} \cdot \frac{a^3 H}{2} \qquad (1)$$

where a is the radius of the sphere, μ the permeability, ρ the specific resistance and $I_{1/2}(v)$ and $I_{5/2}(v)$ are modified Bessel functions of order 1/2 and 5/2 with $v = \left(\frac{4\pi\mu\omega}{\rho}\, j\right)^{1/2}$

It is known[1] that $I_{\frac{1}{2}}(v) = \left(\frac{2}{\pi v}\right)^{1/2} \sinh v \qquad (2)$

and $I_{5/2}(v)$

$$= \left(\frac{2}{\pi v}\right)^{1/2} \left[\left(1 + \frac{3}{v^2}\right) \sinh v - \frac{3}{v} \cosh v\right] \qquad (3)$$

so on substituting in (1) we get

$$P = \frac{\frac{2\mu + 1}{v} \cosh v - \left(1 + \frac{2\mu + 1}{v^2}\right) \sinh v}{\left(1 - \frac{\mu - 1}{v^2}\right) \sinh v + \frac{\mu - 1}{v} \cosh v} \cdot \frac{a^3 H}{2} \quad \cdots \quad \cdots \quad \cdots \quad (4)$$

When this expression is rationalized and reduced to its real and imaginary components it will be in the form

$$P = -\frac{H a^3}{2} (U + jV) \quad \cdots \quad \cdots \quad (5)$$

If $I e^{j\omega t}$ is the equivalent current in the coil the magnetic moment of the dipole will be $P = \pi a^2 I e^{j\omega t}$. I is given by

$$[R + L\omega j]\, I = -\pi a^2 H_0 \omega j \quad \cdots \quad (6)$$

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* MS. accepted by the Editor, April 1946.

where R and L are the equivalent resistance and inductance. Consequently

$$P = -\frac{\pi^2 a^4 H\,\omega\,(R - L\omega j)}{R^2 + L^2\omega^2}\,j \quad \cdots \quad (7)$$

By equating the real and imaginary components of (5) and (7) we get two equations and on solving them the following expressions are obtained for the equivalent resistance and inductance of the sphere :—

$$R = 2\pi^2 a\omega\left(\frac{V}{U^2 + V^2}\right)\text{(abs. e.m.u.)} \quad (8)$$

$$L = 2\pi^2 a\left(\frac{U}{U^2 + V^2}\right)\text{(abs. e.m.u.)} \quad (9)$$

It is useful to have formulae for the change in resistance and inductance of a solenoid when a sphere is placed at its centre as this approximates to the actual conditions in an induction furnace. They can be found by using the well-known equations for coupled circuits

$$\Delta R_1 = \frac{M^2\omega^2 R_2}{R_2{}^2 + (L_2\omega)^2}\,;$$

$$\Delta L_1 = -\frac{M^2\omega^2 L_2}{R_2{}^2 + (L_2\omega)^2} \quad \cdots \quad \cdots \quad (10)$$

It is clear that $M = \alpha\,.\,4\pi n \times \pi a^2 = 4\alpha\pi^2 n a^2$ where n = turns per unit length, l and D = solenoid length and diameter and $\alpha^2 = l^2/(l^2 + D^2)$ so substituting in (10).

$$\Delta R_1 = 8\alpha^2\pi^2 n^2 a^3 \omega V \text{ (abs. e.m.u.)} \quad (11)$$

$$\Delta L_1 = -\,8\alpha^2\pi^2 n^2 a^3 U \text{ (abs. e.m.u.)} \quad (12)$$

Divilkovski[2] gives formulae for the above special case involving the solenoid inductance but on examination it will be found that they only give the correct result when the solenoid length is much greater than the diameter.

The mean rate of heat generation in the sphere W is clearly $\frac{1}{2}\Delta R_1.I_1{}^2$, where $I_1 \cos \omega t$ is the solenoid current. Since the field at the centre of the sphere $H_0 \cos \omega t = \alpha.4\pi n I_1 \cos \omega t$ by eliminating I_1 we can get a formula for the rate of heat generation involving the field strength. It is

$$W = \frac{1}{4}a^3\omega H^2{}_0 V \text{ erg/sec.} \quad \cdots \quad \cdots \quad (13)$$

Non-magnetic Sphere

In this case the dipole moment Eqn. (4) is simplified to

$$P = -\frac{Ha^3}{2}\left[1 + \frac{3}{v^2} - \frac{3}{v}\cdot\frac{\cosh v}{\sinh v}\right] \quad (14)$$

On putting $m = a\left(\frac{2\pi\mu\omega}{\rho}\right)^{1/2}$ we have $v = m(1 + j)$ so

$$P = -\frac{Ha^3}{2}\left[1 + \frac{3}{2m^2 j} - \frac{3}{m(1 + j)}\cdot\frac{\cosh m \cos m + j \sinh m \sin m}{\sinh m \cos m + j \cosh m \sin m}\right]$$

After simplifying this expression it will be found that

$$U = 1 - \frac{3}{2m}\,\frac{\sinh 2m - \sin 2m}{\cosh 2m - \cos 2m} \quad (15)$$

$$V = \frac{3}{2m}\left[\frac{\sinh 2m + \sin 2m}{\cosh 2m - \cos 2m} - \frac{1}{m}\right] \quad (16)$$

When $m > 3$ the above equations reduce to $U = 1 - 3/2\,m$ and $V = \frac{3}{2m}\left(1 - \frac{1}{m}\right)$. The equivalent inductance and resistance are obtained by substituting the above values of U and V in (8) and (9). In Fig. 1 the variation with frequency of the resistance and reactance are shown for the particular case of a copper sphere of 10-cm diameter.

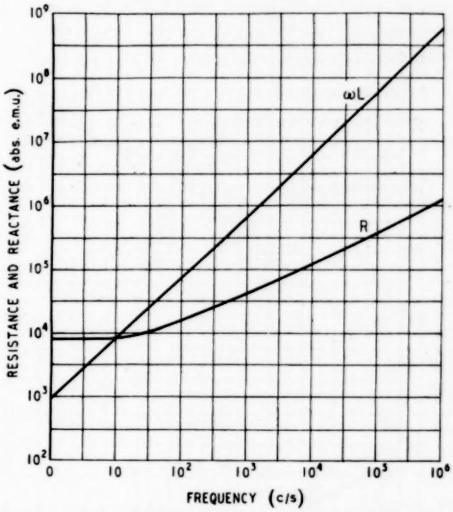

Fig. 1. *Equivalent resistance and reactance of copper sphere (abs. e.m.u.)*

The increase in resistance is, of course, due to the "skin effect" which causes the current to be confined to a thin surface layer when the frequency is high enough. Some inaccurate formulæ for the case of the sphere in the solenoid are given without proof by Jouguet[3].

It should be noted that the dipole field due to eddy currents is opposed to the inducing field and so, when in a non-uniform field, the sphere will behave as a diamagnetic substance and will tend to move from the stronger to the weaker parts of the field.

Magnetic Sphere

When $\mu > 1$ the rationalization of (4) leads to a complicated expression which will not be given here. If $v > 6$ it is simplified somewhat and the dipole moment can then be put in the form

$$P = -\frac{Ha^3}{2}(U + jV) \quad \ldots \quad \ldots \quad (5)$$

where

$$U = \frac{1 - \frac{\mu - 1}{2m} - \frac{(\mu - 1)(2\mu + 1)}{2m^2}\left(1 - \frac{1}{m} + \frac{2}{m^2}\right)}{1 + \frac{\mu - 1}{m} + \frac{(\mu - 1)^2}{2m^2}\left(1 - \frac{1}{m} + \frac{1}{2m^2}\right)} \quad \ldots \quad \ldots \quad \ldots \quad (17)$$

and $$V = \frac{m - 1}{1 + \frac{\mu - 1}{m} + \frac{(\mu - 1)^2}{2m^2}\left(1 - \frac{1}{m} + \frac{1}{2m^2}\right)} \frac{3\mu}{2m^2} \quad \ldots \quad \ldots \quad \ldots \quad (18)$$

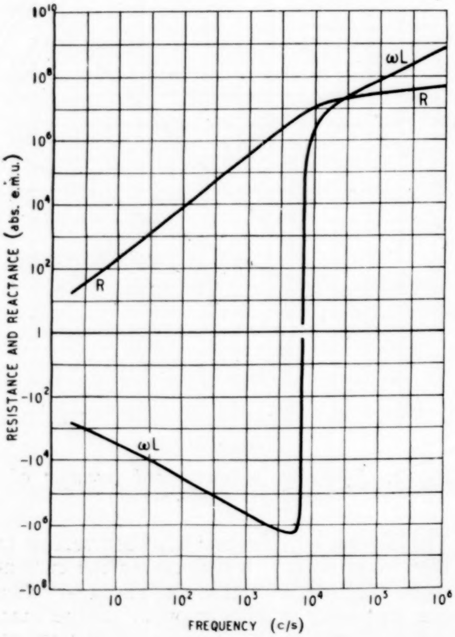

Fig. 2. *Equivalent resistance and reactance of steel sphere* ($\mu = 300$, $\rho = 15 \times 10^3$) *abs. e.m.u.*

The equivalent resistance and inductance can again be found by substitution in (8) and (9). It will be seen that as $m \to \infty$, $R \to 0$ and $L \to 2\pi^2 a$

When $m \ll 1$ it can be shown that

$$P = \frac{2(\mu - 1)}{\mu + 2} \cdot \frac{Ha^3}{2} \quad \ldots \quad \ldots \quad (19)$$

The expression for U, and consequently the inductance, is negative at low frequencies and changes sign when $m = 1.28\,\mu$ (approx.). The explanation of this is that at low frequencies the moment is mainly due to the induced magnetization while at high frequencies the moment of the induced eddy currents is the larger component and the two components are opposed. To look at it from another aspect, it is an elementary fact that the presence of magnetic material in the field of an inductance increases the l.f. inductance and so in (12) ΔL_1 must be positive. It thus follows that L_2 must be negative at low frequencies.

In Fig. 2 the resistance and reactance of a steel sphere $\mu = 300$, $\rho = 15 \times 10^3$ abs. u. are shown.

It should be remembered that the effect of hysteresis has been ignored in the above analysis.

REFERENCES

[1] W. R. Smythe, "Static and Dynamic Electricity," N.Y., 1939
[2] M. Divilkovski, *J. Phys., U.S.S.R.*, Vol. 1, Nos. 5 and 6, 1939
[3] M. Jouguet, *C. R. Acad. Sci., Paris*, May 10, 1943.

Indexes

As is our custom the Index to the Articles and Authors for the current volume is included in this issue.

The Index to the Abstracts and References published throughout the year is in course of preparation and will, it is hoped, be available in February, priced 2s. 8d. (including postage). As supplies will be limited our Publishers ask us to stress the need for early application for copies.

DIPOLE REFLECTOR INSULATION*

Effect on Performance at 6 Metres

By J. A. Saxton, B.Sc., Ph.D., A.M.I.E.E., and
L. H. Ford, M.Sc.(Eng.), A.M.I.E.E.
(Communication from the National Physical Laboratory)

SUMMARY.—The effects of various insulators, used to support the ends of the parasitic aerial, were determined by measurements of the front-to-back signal ratio of a receiving-aerial system consisting of a half-wavelength dipole and a single parasitic reflector, at a wavelength of six metres. The particular insulators used in this investigation resulted in the effective length of the reflector being increased by about 20 per cent.

1. Introduction

THE simplest form of reflector which can be used to improve the performance of an aerial is a single conductor, about half a wavelength long. Such reflectors are commonly supported by strain insulators at the ends; when this is done the presence of the insulators may considerably alter the characteristics of the reflector, and the optimum length of conductor may differ from that computed from theory. The paper describes some experiments undertaken to determine the effect of the insulators on a reflecting curtain which failed to give the expected performance when first erected. It is supplementary to a previous paper on dipole reflectors by one of the authors.[1]

2. Experimental Procedure

A horizontally-polarized electric field on a wavelength of six metres was set up at the receiving site by means of a small oscillator the aerial current of which was maintained constant. The oscillator was about 150 metres distant from the receiver. The receiving-aerial system was mounted on a platform about 20ft above ground level. The receiving aerial consisted of a horizontal half-wave dipole aerial mounted on a wooden

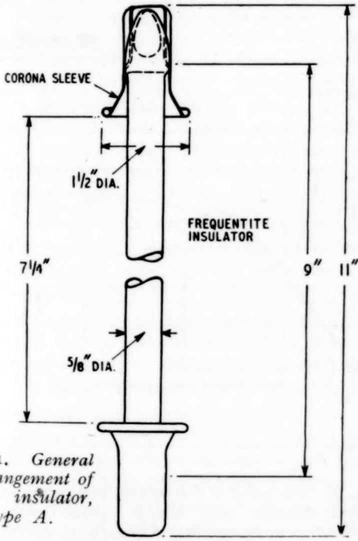
CORONA SLEEVE
1½" DIA.
FREQUENTITE INSULATOR
7¼"
9"
11"
⅝" DIA.

Fig. 1. *General arrangement of rod insulator, type A.*

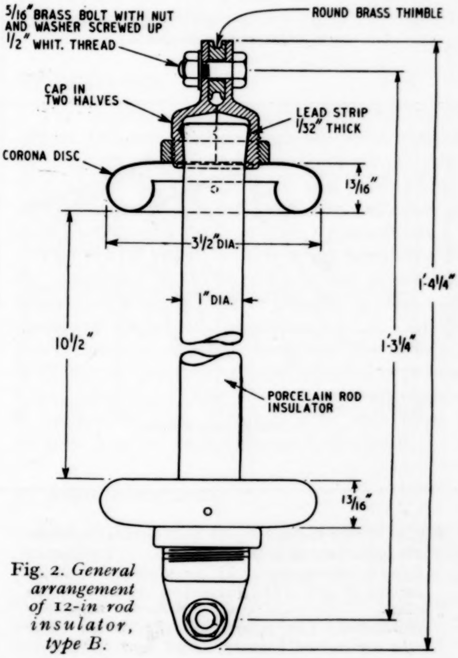
5/16" BRASS BOLT WITH NUT AND WASHER SCREWED UP ½" WHIT. THREAD
ROUND BRASS THIMBLE
CAP IN TWO HALVES
LEAD STRIP 1/32" THICK
CORONA DISC
13/16"
3½" DIA.
1" DIA.
1'-4¼"
10½"
1'-3¼"
PORCELAIN ROD INSULATOR
13/16"

Fig. 2. *General arrangement of 12-in rod insulator, type B.*

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* MS accepted by the Editor, April 1946.

[1] J. S. McPetrie and J. A. Saxton: "Some Experiments on Linear Aerials." *Wireless Engineer*, April 1946, Vol. 23, p. 107.

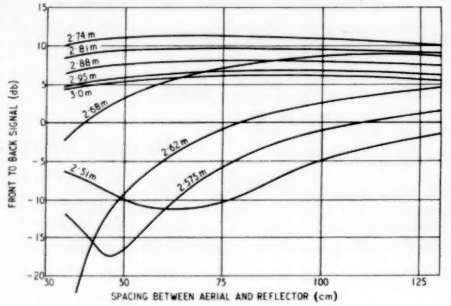

Fig. 3

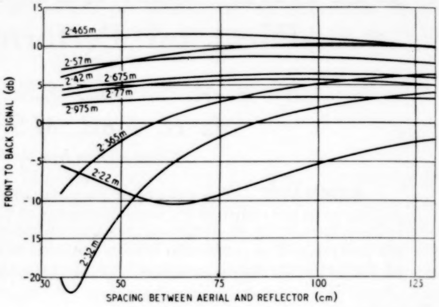

Fig. 4

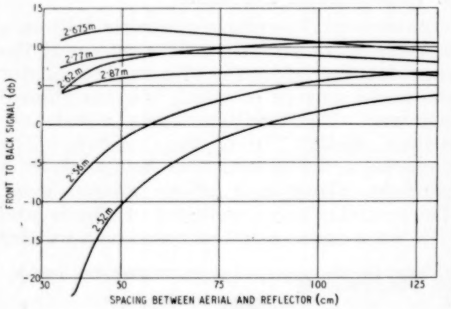

Fig. 5

Fig. 3. *Front-to-back signal with various reflector lengths at λ = 6.0 metres using insulators A, with corona rings. The reflector lengths measured include insulator corona rings.*

Fig. 4. *Front-to-back signal with various reflector lengths at λ = 6.0 metres using insulators B, with corona rings. The reflector lengths measured include insulator corona rings.*

Fig. 5. *Front-to-back signal with various reflector lengths at λ = 6.0 metres using insulators B, without corona rings. The reflector lengths measured include insulator caps.*

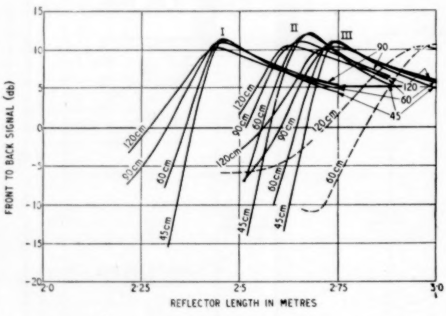

Fig. 6

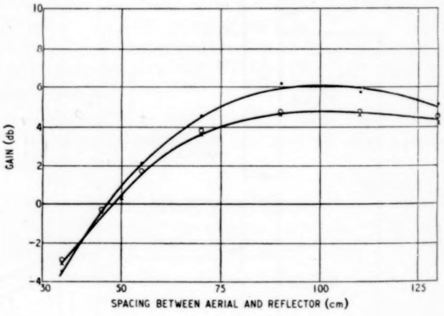

Fig. 7

Fig. 6. *Front-to-back signal with various reflector arrangements at λ = 6.0 metres. I. Insulators B, with corona rings; II. Insulators B, without corona rings; III. Insulators A, with corona rings. — — — — computed curves neglecting insulators. The figures on the curves show the separation between aerial and reflector.*

Fig. 7. *Gain at λ = 6.0 metres with dipole aerial and reflector over simple dipole aerial, in direction of transmitter.* ● *Insulators A, reflector length 2.74 metres;* ×, *insulators B, with corona rings, reflector length 2.465 metres;* ○ *insulators B, without corona rings, reflector length 2.675 metres.*

frame, and connected to the input terminals of a field-strength measuring set by a vertical length of about one metre of twin flexible leads. The parasitic reflector consisted of a length of 200-lb copper wire (approximately 0.116-in diam.) strained between two insulators, which were mounted on the wooden frame supporting the receiving aerial in such a way that the separation of the two aerials, which were in the same horizontal plane, could be varied. The field strength was measured with various separations between the receiving and parasitic aerials, with the latter successively in front of and behind the former at each distance of separation. From these measurements the front-to-back signal ratio of the aerial system was obtained. The gain in signal in the direction of the transmitter over that received with a simple dipole aerial was also derived. Successive series of measurements were made using a number of lengths of parasitic aerial and a number of types of supporting insulator. The maximum error of any measurement was ±1 db.

3. Experimental Results

Three sets of observations were made, each with a different insulator arrangement.

(i) A series of experiments with various reflector lengths of between 3.0 metres and 2.51 metres, and aerial separations of between 35 cm and 130 cm, using insulators of type A. These were Frequentite insulators, with copper corona sleeves, shown in Fig. 1. The reflector lengths were measured, including the corona rings, which formed part of the conducting system. The values of front-to-back signal ratio, are shown plotted in Fig. 3.

(ii) A series of experiments with various reflector lengths of between 2.975 metres and 2.22 metres and aerial separations of between 35 cm and 130 cm, using insulators of type B. These were 12-in porcelain rod insulators 1-in diameter, with $\frac{3}{4}$-in roll, $3\frac{1}{2}$-in diameter corona discs, shown in Fig. 2. The reflector lengths were measured including the corona discs, which formed part of the conducting system. The values of front-to-back signal ratio are shown plotted in Fig. 4.

(iii) A series of experiments with various reflector lengths of between 2.87 metres and 2.52 metres, and aerial separations of between 35 cm and 130 cm, using insulators type B with the corona discs removed. The reflector lengths were measured including the metal caps on the ends of the insulators. The values of front-to-back signal ratio are shown plotted in Fig. 5.

From the curves of Figs. 3, 4 and 5, a further Fig. 6 was derived. This shows the result of varying the length of the reflector with fixed spacings between the receiving aerial and reflector of 45 cm, 60 cm, 90 cm, and 120 cm corresponding to 0.075 λ, 0.1 λ, 0.15 λ and 0.2 λ respectively. Computed curves are also shown for a simple reflector with no insulators at the ends.

Fig. 7 shows the variation of signal gain with a reflector over that without, plotted against the spacing between aerial and reflector. The length of reflector was that which gave maximum front-to-back signal ratio for each of the three insulator arrangements. The aerial system was normal to the direction of the transmitter throughout the experiments. The accuracy of these results is somewhat less than those plotted in the previous figures, since the field strength with the simple dipole receiving aerial, on which the results are based, was only measured at infrequent intervals during the experiments.

4. Conclusions

The results obtained in the series of experiments described above are in good general agreement with those described previously.[1] The effect of the metal caps and corona rings on the effective length of the reflector is clearly brought out by the experiments.

The metal corona sleeves on insulator A, for example, add 10 cm to the conductor length, but the effective length of the conductor is increased by about 35 cm. In the worst case the effective length of the reflector is about 20 per cent greater than the geometrical length; if the effect of the insulators is neglected with a reflector of this type a serious loss in performance will result.

5. Acknowledgments

The work described above was carried out as part of the programme of the Radio Research Board, to whom the paper was first circulated in October 1941. It is now published by permission of the Department of Scientific and Industrial Research.

ZERO TRACKING ERROR IN SUPERHETERODYNES*

By A. Bloch, Dr.-Ing., M.Sc.

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SUMMARY.—A pair of circuits is described which gives zero tracking error not only on three selected positions of the tuning range, but over the entire tuning range. Tuning is effected by a simultaneous variation of inductance and capacitance elements, such that the ratio L/C remains constant throughout the tuning range.

It is shown that small errors in this condition lead only to second-order tracking errors.

THE solutions of the tracking problem which have become known so far are all approximate ones—the usual one, for instance, giving zero tracking error at only three tuning positions; over the rest of the tuning range a small but finite tracking error has to be allowed.

For this reason the present note might be of interest, as it describes a simple pair of circuits which gives correct tracking (zero tracking error) over the entire tuning range.† This circuit pair is of the type in which tuning is carried out by a simultaneous variation of the inductance and the capacitance elements. The special feature introduced here is the condition that the ratio L/C of these two elements remains constant throughout the tuning range.

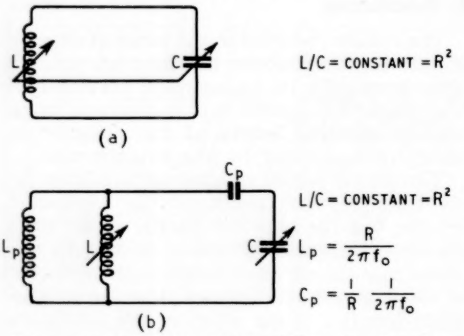

Fig. 1. *Signal (a) and oscillator (b) circuits resonant respectively at frequencies f and $f_1 = f + f_0$.*

If this condition is fulfilled, then the circuit pair illustrated in Figs. 1 (a) and 1 (b) gives ideal tracking with constant frequency difference (f_o) over the entire tuning range, while the circuit pair illustrated in Figs. 2 (a) and 2 (b) gives ideal tracking with constant difference (λ_0) of wavelength.

We shall first give the proof for the usual case of constant frequency difference.

Let

$$\omega = 2\pi f = 1/\sqrt{LC}$$
$$= \text{tuning frequency of circuit 1 (a)} \qquad (1)$$
$$\omega_1 = 2\pi f_1 = 1/\sqrt{L_1 C_1}$$
$$= \text{tuning frequency of circuit 1 (b)} \qquad (2)$$

where

$$L_1 = \frac{LL_p}{L + L_p} \quad \text{and} \quad C_1 = \frac{CC_p}{C + C_p} \qquad (3)$$

Let δ be the mechanical position coordinate of the tuning mechanism such that

$$L = L_0 \,.\, \phi(\delta) \quad \ldots \quad \ldots \quad (4)$$

Then the constant L/C ratio, which we stipulated, requires $L/C = L_0/C_0 = R^2$, say; hence

$$C = C_0 \,.\, \phi(\delta) \quad \ldots \quad \ldots \quad (5)$$

and

$$\omega = \frac{1}{\phi(\delta) \,.\, \sqrt{L_0 C_0}} \quad \text{or} \quad \phi(\delta) = \frac{1}{\omega\sqrt{L_0 C_0}} \quad \ldots \quad \ldots \quad (6)$$

$$L = \sqrt{L_0/C_0}/\omega = R/\omega \quad \ldots \quad \ldots \quad (7)$$
$$C = \sqrt{C_0/L_0}/\omega = 1/\omega R \quad \ldots \quad \ldots \quad (8)$$

Together with the stipulated values

$$L_p = R/\omega_0 \quad \ldots \quad \ldots \quad \ldots \quad (9)$$
$$C_p = 1/\omega_0 R \quad \ldots \quad \ldots \quad \ldots \quad (10)$$

we get

$$L_1 = \frac{R/\omega \,.\, R/\omega_0}{R/\omega + R/\omega_0} = \frac{R}{\omega + \omega_0} \quad \ldots \quad (11)$$

$$C_1 = \frac{1/R\omega \,.\, 1/R\omega_0}{1/R\omega + 1/R\omega_0} = \frac{1}{R} \cdot \frac{1}{\omega + \omega_0} \quad (12)$$

$$\omega_1 = 1/\sqrt{L_1 C_1} = \omega + \omega_0 \quad (13) \text{ Q.E.D.}$$

The proof for the case illustrated in Figs. 2 (a) and 2 (b) follows either from the general theorem, given in "Notes on Tracking

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* MS. accepted by the Editor, April 1946.

† British Patent Specification No. 578960 of 23rd October 1942.

Circuits "[1] or, in the present case, quicker still, by independent calculation.

If we denote $\frac{2\pi c}{\lambda'}$ by ω' and $\frac{2\pi c}{\lambda_0}$ by ω_0 (c = velocity of el. magn. waves), we have

$$L' = R/\omega' \qquad C' = 1/\omega' R \quad .. \quad (14)$$

and

$$L'_1 = L' + L_p = R\,(1/\omega' + 1/\omega_0) \quad (15)$$

$$C'_1 = C' + C_p = \frac{1}{R}\left(1/\omega' + 1/\omega_0\right) \quad (16)$$

$$\lambda'_1 = \frac{2\pi c}{\omega'_1} = 2\pi c\,\sqrt{L'_1 C'_1}$$

$$= 2\pi c\left(\frac{1}{\omega'} + \frac{1}{\omega_0}\right) = \lambda' + \lambda_0 \quad .. \quad (17)$$

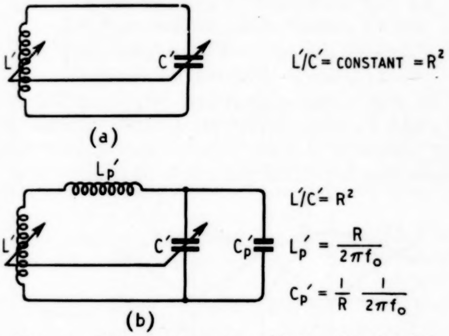

Fig. 2. *Signal (a) and oscillator (b) circuits resonant respectively at wavelengths λ and $\lambda'_1 = \lambda' + \lambda_0$.*

If the variation of L and C is such that their ratio does not remain exactly constant, a tracking error will of course arise. It is of interest, however, that this error will be of second order if the ratio error is of first order.

To calculate the error, we introduce $S = 1/C$ so that the constant L/C ratio is now transformed into a constant $L \cdot S$ product. If there are errors in the dimensioning of the tuning elements we can then always put

$$S = S_t + \Delta S \quad .. \quad .. \quad .. \quad (18)$$

where ΔS indicates the deviation from the ideal condition. The tracking error is then

$$\Delta f = \frac{f_0}{8} \cdot \frac{f}{f_1} \cdot \left(\frac{\Delta S}{S_t}\right)^2 \quad .. \quad .. \quad (19)$$

or, if we introduce with analogous meaning

$$C = C_t + \Delta C \left(C_t = \frac{1}{S_t},\ C = \frac{1}{S}\right) \quad (20)$$

$$\Delta f \approx \frac{f_0}{8} \cdot \frac{f}{f_1} \cdot \left(\frac{\Delta C}{C_t}\right)^2 \quad .. \quad .. \quad (21)$$

Proof of equation (19).

If we put

$$1/C_p = S_p \quad \text{and} \quad 1/C_1 = S_1 \quad .. \quad (22)$$

we have

$$S_1 = S_t + S_p + \Delta S = S_{1t} + \Delta S \quad (23)$$

If we take the values

$$\omega_t = \sqrt{\frac{S_t}{L_1}} \quad \text{and} \quad \omega_{1t} = \sqrt{\frac{S_{1t}}{L}} \quad .. \quad (24)$$

as reference values, and use a Taylor expansion to calculate the deviations $\delta\omega$ and $\delta\omega_1$ which are due to the increment ΔS, we get,

$$\delta\omega = \frac{1}{2\sqrt{LS_t}} \cdot \Delta S - \frac{1}{8\sqrt{LS_t^3}} \cdot \Delta S^2 + \ldots \quad .. \quad .. \quad (25)$$

$$\delta\omega_1 = \frac{1}{2\sqrt{L_1 S_{1t}}} \Delta S - \frac{1}{8\sqrt{L_1 S_{1t}^3}} \Delta S^2 + \ldots \quad .. \quad .. \quad (26)$$

The tracking error is then (in angular frequency)

$$\Delta\omega_0 = \delta\omega_1 - \delta\omega \quad .. \quad .. \quad (27)$$

Now, as we have

$$\frac{1}{\sqrt{L_1 S_{1t}}} = \sqrt{\frac{C_{1t}}{L_1}} = \frac{1}{R} = \sqrt{\frac{C}{L}} = \frac{1}{\sqrt{L \cdot S_t}} \quad .. \quad .. \quad (28)$$

the two first order terms for $\delta\omega$ and $\delta\omega_1$ cancel and we are left with

$$\Delta\omega_0 = -\frac{1}{8}\,\frac{1}{R}\left[\frac{1}{S_{1t}} - \frac{1}{S_t}\right]\Delta S^2 \quad .. \quad (29)$$

$$= +\frac{1}{8} \cdot \frac{1}{\sqrt{L_p S_p}} \cdot \frac{S_p}{S_{1t} \cdot S_t} \cdot \Delta S^2$$

$$= \frac{1}{8}\,\omega_0 \frac{S_t^2}{S_{1t} \cdot S_t}\left(\frac{\Delta S}{S_t}\right)^2$$

$$= \frac{1}{8}\,\omega_0 \cdot \frac{\omega}{\omega + \omega_0}\left(\frac{\Delta S}{S_t}\right)^2$$

or

$$\Delta f = \frac{1}{8} f_0 \cdot \frac{f}{f_1}\left(\frac{\Delta S}{S_t}\right)^2 \quad .. \quad .. \quad (30)$$

The question of physical realization of the components required in this scheme has not been dealt with in these notes. It may be mentioned, therefore, that the scheme has been applied without difficulty in a case in which the tuning frequency varied over a range of 1 : 6.

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[1] *Wireless Engineer*, Nov. 1942, Vol. 19, p. 508.

PHASE DETECTORS*

Some Theoretical and Practical Aspects

By L. I. Farren, Whit. Schol., A.M.I.E.E., A.C.G.I., D.I.C.

(Communication from the Staff of the Research Laboratories of The General Electric Company Limited, Wembley, England.)

SUMMARY.—The theory of operation of various forms of phase detector is developed, for the case when the applied voltages are sinusoidal and when they are rectangular.

A number of practical forms of circuit are considered and the results of measurements made on these circuits are given.

Introduction

The various fundamental methods of measuring the phase difference between two sinusoidal voltages of the same frequency are well known and have been described by M. Levy.[1] In practice it is often desirable that the phase detector employed should produce at its output terminals a steady potential, the polarity of which depends on whether the phase angle is lagging or leading, and the magnitude of which is as nearly as possible proportional to the phase difference.

In some other applications it is necessary for the output from the phase detector to operate control relays when the phase angle deviates from zero by more than a specified amount, one relay operating for leading angles and another for lagging.

In such applications the main requirement is for a high conversion factor from phase angle to output potential, while a subsidiary requirement is that this output potential should be substantially independent of the amplitudes of the voltages whose phase difference is to be measured.

In the phase detectors to be considered these requirements are taken into account.

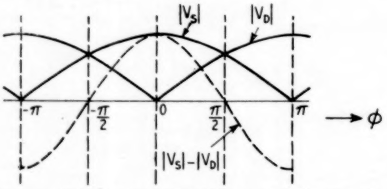

Fig. 1. The magnitudes $|V_D|$ and $|V_S|$ and their difference are shown here as functions of the phase angle ϕ.

Suppose we wish to measure the phase difference between two alternating voltages $V_1 \sin \omega t$ and $V_2 \sin (\omega t + \phi)$.

If separate amplifiers, with a.v.c. applied, are used to amplify V_1 and V_2, it is possible to obtain two output voltages of the same amplitude, say, $V_3 \sin \omega t$ and $V_3 \sin (\omega t + \phi)$. If these outputs are combined in such a way that their sum and difference are obtained separately we get,

$$\left.\begin{aligned} V_S &= V_3 \sin \omega t + V_3 \sin (\omega t + \phi) \\ &= 2V_3 \cos (-\phi/2) \sin (\omega t + \phi/2) \\ V_D &= V_3 \sin \omega t - V_3 \sin (\omega t + \phi) \\ &= 2V_3 \sin (-\phi/2) \cos (\omega t + \phi/2) \end{aligned}\right\} \quad \ldots \quad (1)$$

In Fig. 1, the magnitudes $|V_S|$ and $|V_D|$ of V_S and V_D respectively are plotted against ϕ for values of ϕ from $-\pi$ to $+\pi$, and on the same base is plotted the curve of $|V_S| - |V_D|$.

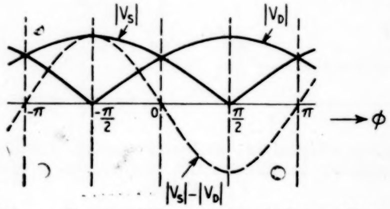

Fig. 2. Curves of $|V_D|$, $|V_S|$ and $|V_S| - |V_D|$ are shown here for the case when one voltage is $V_3 \sin (\omega t + \phi + \pi/2)$.

This latter curve is sinusoidal and has peak values at $\phi = 0$ and $\phi = \pm n\pi$. Hence the quantity $|V_S| - |V_D|$ possesses no characteristic to indicate whether ϕ is positive (lead) or negative (lag).

If now one of the voltages, say, $V_3 \sin (\omega t + \phi)$, is made to lead by an additional angle of $\pi/2$ on the other, we have

$$\begin{aligned} V_S &= V_3 \sin \omega t + V_3 \sin (\omega t + \phi + \pi/2) \\ &= 2V_3 \cos (-\pi/4 - \phi/2) \sin (\omega t + \phi/2 + \pi/4) \quad \ldots \quad \ldots \quad (2) \\ V_D &= V_3 \sin \omega t - V_3 \sin (\omega t + \phi + \pi/2) \\ &= 2V_3 \sin (-\pi/4 - \phi/2) \cos (\omega t + \phi/2 + \pi/4) \end{aligned}$$

In Fig. 2, the magnitudes $|V_S|$ and $|V_D|$ of V_S and V_D respectively derived from equation (2), are plotted against ϕ together with the curve of $|V_S| - |V_D|$.

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*MS. accepted by the Editor, April 1946.

It will be seen that the quantity $|V_S|-|V_D|$ changes sign at $\phi = 0$, being positive when ϕ is negative (lag) and negative when ϕ is positive (lead).

If the added phase shift is made $-\pi/2$ instead of $+\pi/2$, the curve for $|V_S| - |V_D|$ will still change sign at $\phi = 0$, but it will have positive values when ϕ is positive and vice versa.

In phase detectors employing the sum and difference method it is usual therefore to shift the phase of one of the voltages by $\pm\pi/2$.

In order to keep the notation consistent, the additional phase shift of $\pi/2$ will be added to the voltage $V_3 \sin(\omega t + \phi)$.

From the foregoing discussion it will be seen that the formation of the voltages V_S and V_D is accomplished by the vectorial addition of two sinusoidal quantities. The formation of the quantity $|V_S| - |V_D|$ is based on the assumption that the magnitudes $|V_S|$ and $|V_D|$ may be subtracted one from the other, irrespective of the signs or relative phases of V_S and V_D.

In practice this may be accomplished by the use of a diode rectifier circuit which provides at its output terminals a unidirectional voltage proportional to the peak value of the alternating voltage at its input.

Thus by applying V_S and V_D to separate rectifier circuits and by connecting the outputs in such a way that their output voltages oppose each other, a combination proportional to $|V_S| - |V_D|$ may be obtained.

Before dealing with the various forms of phase detector we shall first consider the simple diode rectifier and output circuit, as the method used in dealing with this case is of use when considering the more complicated circuits.

The Diode Rectifier and Load Circuit

The circuit is shown in Fig. 3. The resistance R_1 represents the combination of a physical resistance in series with the forward conducting resistance of the rectifier G. The load circuit consists of the resistance R_2 in parallel with the capacitance C. The input voltage applied to the circuit is $V_a \cos \omega t$ and the resultant output voltage is V_A.

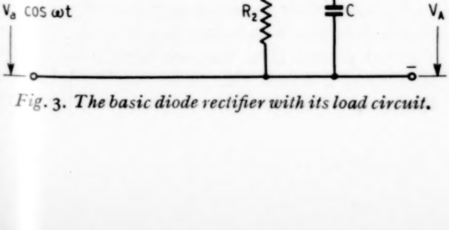


Fig. 3. *The basic diode rectifier with its load circuit.*

We wish to find V_A in terms of V_a, R_1, R_2 and C. The following assumptions are made :—

(*a*) The forward conducting resistance of G is small compared with R_1 and is constant for all positive values of applied voltage. In practice, when a phase detector is working over the range which is of interest, the voltage V_a is generally greater than 10 volts, so that this assumption is not unreasonable.

(*b*) The backward resistance of G is large compared with R_2.

(*c*) The time constant CR_2 is large compared with the period of one cycle of the applied signal, namely, $2\pi/\omega$. In such a case, the voltage V_A is independent of C.

If these assumptions are valid, then once the transient charging period of C has passed, the voltage V_A remains substantially constant over each a.c. cycle and acts as a steady bias on the rectifier.

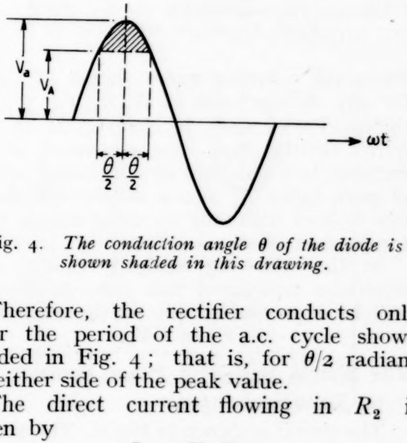


Fig. 4. *The conduction angle θ of the diode is shown shaded in this drawing.*

Therefore, the rectifier conducts only over the period of the a.c. cycle shown shaded in Fig. 4; that is, for $\theta/2$ radians on either side of the peak value.

The direct current flowing in R_2 is given by

$$I_A = V_A/R_2$$

The current necessary to keep C charged is provided by the rectifier over the periods shown shaded in Fig. 4. The average value of this current must obviously equal I_A.

$$\therefore\ I_A = V_A/R_2$$

$$= \frac{V_a}{2\pi R_1}\int_{-\theta/2}^{+\theta/2} (\cos\omega t - V_A/V_a)\, d(\omega t).$$

From Fig. 4 we see that

$$V_A/V_a = \cos\theta/2$$

$$\therefore V_A/R_2 = \frac{V_a}{2\pi R_1}\int_{-\theta/2}^{+\theta/2}(\cos \omega t - \cos \theta/2)\, d\,(\omega t)$$

$$= \frac{V_a}{2\pi R_1}(2 \sin \theta/2 - \theta \cos \theta/2)$$

and $$\frac{R_2}{R_1} = \frac{2\pi \cos \theta/2}{2 \sin \theta/2 - \theta \cos \theta/2} \quad .. \quad (3)$$

This equation may be expressed in a more useful form by plotting R_2/R_1 against $\cos \theta/2$.

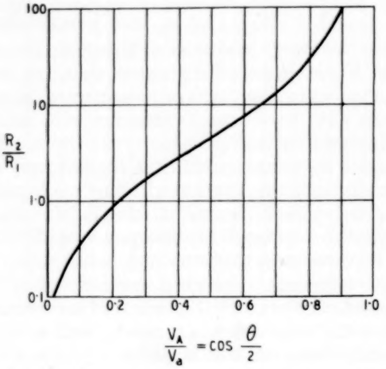


Fig. 5. *The relationship between V_A/V_a and R_2/R_1 for the circuit of Fig. 3.*

From the resulting curve shown in Fig. 5, for any chosen value of R_2/R_1, $\cos \theta/2$ and thence V_A/V_a may be found. It is seen quite clearly that the efficiency of the rectifier, in converting an alternating voltage of peak value V_a into a steady voltage V_A, can be kept high only by using a large value for the ratio R_2/R_1.

In the following analysis, except when otherwise necessary, this lack of efficiency will be expressed simply by the relationship

$$V_A = KV_a.$$

The Simple Push-Pull Phase Detector

(a) Sinusoidal Input.

The circuit is shown in Fig. 6. The alternating voltages, whose phase difference $\phi + \pi/2$ is to be indicated in terms of ϕ only, are $v_1\,(a)$ and $v_2\,(c)$, and by means of the transformers T_1 and T_2 the sum of $v_1\,(a)$ and $v_2\,(c)$ and the difference of $v_1\,(b)$ and $v_2\,(c)$ may be applied separately to the two rectifiers G_A and G_B respectively.

It has already been mentioned in the introduction that means are readily available for making the amplitudes of v_1 and v_2 the same. Thus if we take $v_1\,(a)$ as our datum voltage we have :

$$v_1\,(a) = V_1 \sin \omega t$$
$$v_2\,(c) = V_1 \sin (\omega t + \phi + \pi/2).$$

The alternating voltage applied to rectifier

$$G_A = V_a = v_1\,(a) + v_2\,(c)$$
$$G_B = Vb = v_2\,(c) - v_1\,(b)$$
$$\therefore V_a = 2V_1 \cos (-\pi/4 - \phi/2) \sin (\omega t + \phi/2 + \pi/4)$$
$$V_b = 2V_1 \sin (-\pi/4 - \phi 2) \cos (\omega t + \phi/2 + \pi/4)$$

If the efficiency of rectification, as determined from Equ. (3) is K, then we have for the rectified output voltages V_A and V_B,

$$\left.\begin{aligned} V_A &= 2KV_1\,|\cos - (\pi/4 + \phi/2)| \\ V_B &= 2KV_1\,|\sin - (\pi/4 + \phi/2)| \end{aligned}\right\}(4)$$

Since the rectifiers are unidirectional conductors, the output terminals A and B must both be at positive potentials with respect to the common point of the resistors R_2.

Hence the effective output voltage V_C expressed as the potential of A relative to B is,

$$V_C = V_A - V_B$$
$$= 2KV_1 \big[|\cos - (\pi/4 + \phi/2)| - |\sin - (\pi/4 + \phi/2)|\big] \quad .. \quad (5)$$

The curve of V_C plotted against ϕ will be similar in shape to the curve for $|V_S| - |V_D|$ in Fig. 2, having zero values at $\phi = 0$ and $\pm n\pi$, and maximum positive and negative values at $\phi = -n\pi/2$ and $+n\pi/2$ respectively.

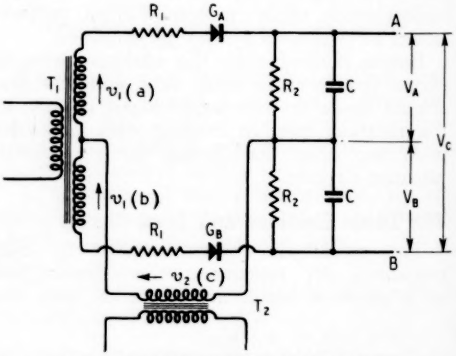


Fig. 6. *Simple push-pull phase detector.*

Summarizing we may say that this type of phase detector has a sine-law relation between V_C and ϕ and that the maximum sensitivity is obtained when the ratio R_2/R_1 is kept as high as possible. In a practical case the resistances R_1 would be formed by the internal impedances of the generators feeding the transformers T_1 and T_2.

Let us consider the application of this detector to a relay control circuit. We have seen that although the terminals A and B are themselves never negative with respect to their centre point, the voltage V_C varies sinusoidally when plotted against ϕ.

In order to operate one relay for positive values of ϕ and another for negative values, an arrangement as shown in Fig. 7 could be used.

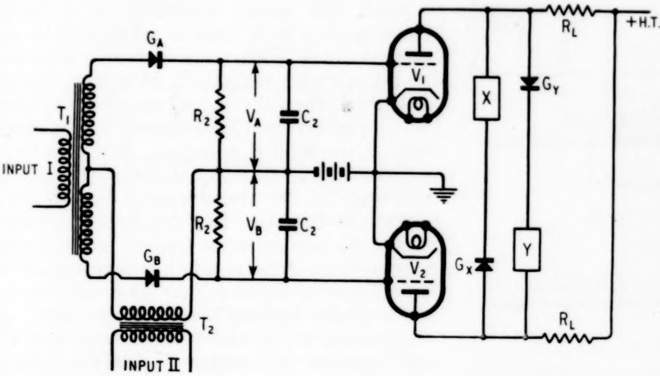


Fig. 7 (above). *Phase detector for operating relays X and Y.*

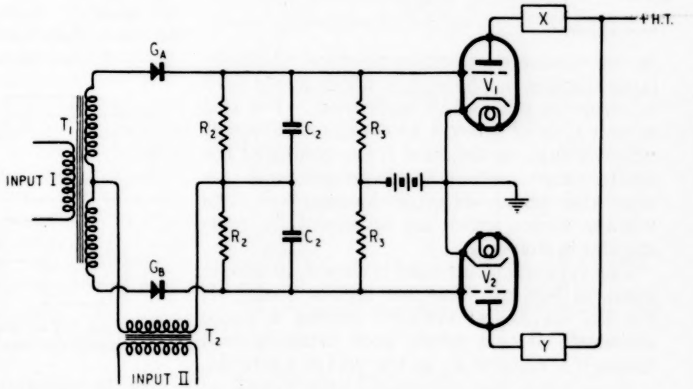


Fig. 8 (right). *An alternative circuit to Fig. 7 for use with relays.*

If the valves V_1 and V_2 are identical in their characteristics, then when $\phi = 0$, $V_A = V_B$ and their anode potentials will be equal. Hence no current will flow in either of the relays X and Y.

If ϕ is negative, V_A is greater than V_B and the anode potential of V_1 falls as that of V_2 rises. Current will flow through the rectifier G_x and relay X, which will operate if $V_A - V_B$ is large enough. If ϕ is positive, then by the same reasoning current will flow through G_y and relay Y.

The advantage of this system is that the valves may be operated on the linear part of their characteristics, thus ensuring maximum sensitivity. The disadvantage is the introduction of two additional rectifiers and the necessity for an initial balance of the anode potentials of the two valves.

An alternative circuit arrangement is shown in Fig. 8; it differs from that shown in Fig. 7 in that the common point of the resistors R_2 and capacitors C_2 is isolated from the cathodes of V_1 and V_2. Instead, two resistors R_3 are connected across the output terminals, and the cathodes are connected, through a negative grid bias supply, to the common point of these resistors.

The steady voltage across each resistor R_3 is equal to $\frac{V_A - V_B}{2}$ or $V_C/2$; thus if V_A is greater than V_B the grid of V_1 becomes more positive with respect to its cathode whilst the grid of V_2 becomes more negative. Hence the relays X and Y will operate for certain negative and positive values of ϕ respectively.

(*b*) *Square Wave Input.*

In order that the sensitivity of phase detection shall remain substantially constant for a wide range of values of input voltage to the receiver, it is necessary to keep the amplitudes substantially constant. This may be achieved by the use of delayed a.v.c. or by using a limiter stage with tuned output to preserve the sinusoidal form of the voltage V_1.

Practical difficulties arise with the latter method owing to possible variations in the tuned circuit; the phase shift introduced by the tuned circuit changes most rapidly at resonance, and small percentage changes in the resonant frequency produce relatively large changes in phase shift which would lead to errors in phase-shift indication. For this reason it is of interest to consider the result which would be obtained if the tuning of the limiter-stage output is dispensed with, so that the phase detector is supplied with voltage waves which are substantially rectangular in shape.

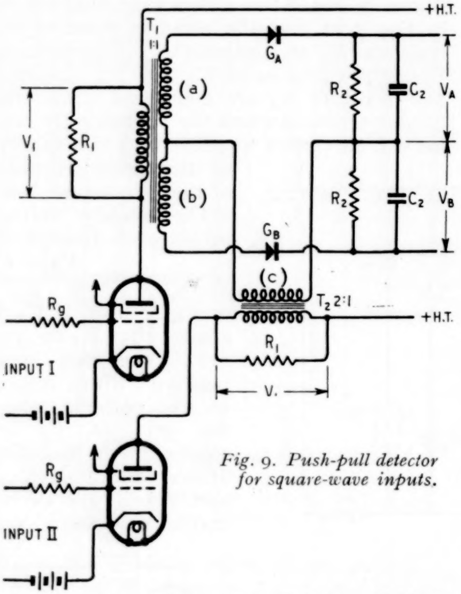


Fig. 9. Push-pull detector for square-wave inputs.

The type of circuit used is shown, in simple form, in Fig. 9. The two inputs, I and II, are the sinusoidal voltages having a phase difference of $(\pi/2 + \phi)$, each being applied through a resistor R_g to the grid of a tetrode.

Each valve has its control grid biased so that the anode current in the absence of a signal is approximately half the value of the anode current at zero grid voltage. The value of R_g is made sufficiently large to ensure that the grid potential of each valve is prevented, by the flow of grid current, from ever becoming more than, say, 1 volt positive to cathode, even in the presence of the positive peak of the largest applied signal.

For example, suppose that the grid current characteristics of the valve are such that a positive potential of 1 volt between grid and cathode corresponds to a grid current of 100 microamperes. Then if $R_g = 250{,}000$ ohms, and the normal grid bias is -3 volts, an input signal of 29 volts peak is needed to drive the grid positive by 1 volt.

This method of limiting is well known and has the effect of converting an input voltage signal of sinusoidal wave form into an anode current of substantially square waveform.

For successful operation, therefore, the input signals must be large compared with the normal grid bias voltage.

Since the anode resistance of a tetrode valve is very high, such a valve may be considered as a controlled-current generator. If the current waveform is square, as just described, then the waveform of the voltage developed across a load circuit will be square only if the load is resistive. For this reason resistors R_1 are connected across the primary windings of the transformers T_1 and T_2 as shown in Fig. 9. Fig. 10 shows the waveforms of the voltages (*a*), (*b*) and (*c*) which appear across the secondary windings of the transformers T_1 and T_2. The waveform of (*c*) is shown lagging by $(\pi/2 + \phi)$ behind (*a*).

The sum of (*a*) and (*c*) represents the voltage applied to rectifier G_A and the sum of (*b*) and (*c*) represents the voltage applied to G_B. The wave forms of (*a*) + (*c*) and (*b*) + (*c*) are shown in Fig. 11.

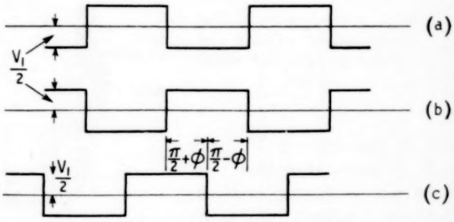


Fig. 10. The waveforms of the voltages on the transformer secondaries of Fig. 9 are shown here.

It is interesting to note the difference between these combined voltages and those obtained in the case of sinusoidal voltage waves. In the latter case, a change of ϕ produced a differential change in the amplitudes of the combined waves, and this change in amplitudes was used as a means of measuring ϕ. In the case of square-wave voltages the amplitudes of the combined waves are unaffected but the shapes of the waves are changed. Both (*a*) + (*c*) and (*b*) + (*c*) consist of a succession of alternate positive and negative rectangular pulses, the width of the pulses being dependent on ϕ.

From Fig. 11 we see that the width of the pulses of (*a*) + (*c*) is $(\pi/2 - \phi)$ and of (*b*) + (*c*) is $(\pi/2 + \phi)$.

We see also that when the positive pulse of (*a*) + (*c*) is being applied to the rectifier G_A, (*b*) + (*c*) is zero and when the positive pulse of (*b*) + (*c*) is being applied to the rectifier G_B, (*a*) + (*c*) is zero. Thus only one-half winding of the secondary of transformer T_1 is loaded at any time and this fact enables a simplification to be made in drawing the equivalent circuit for Fig. 9. This equivalent circuit is shown in Fig. 12, in which the transformers have been removed and the equivalent generators have been inserted. It should be mentioned here that the voltages V_1 shown across the primaries of T_1 and T_2 in Fig. 9 are the voltages which would appear across R_1 if the secondary windings of T_1 and T_2 were open circuited.

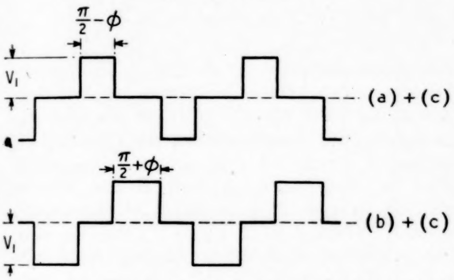


Fig. 11. The waveform of voltage (a) + (c) applied to G_A and of voltage (b) + (c) applied to G_B.

Referring again to Fig. 12; we have to find the steady potential acquired by the capacitors C_2 when the rectifiers G_A and G_B are supplied with the voltage waves shown in Fig. 11. If the time constant C_2R_2 is made large compared with the period of V_1 then V_A and V_B may be considered as steady voltages.

If R_2 is made very much greater than R_1, V_A will approximate to the peak value of the voltage (*a*) + (*c*), namely, V_1, independently of the value of ϕ, except for values of ϕ very close to $\pi/2$, when the voltage wave (*a*) + (*c*) becomes a series of positive and negative "spikes" of short duration. The same remarks apply to the voltage V_B except that the discontinuity occurs in that case for values of ϕ very close to $-\pi/2$.

In other words, if the rectification circuits are designed on the principle of the diode peak voltmeter (which is best for the case of sinusoidal inputs) then one loses the differential action of V_A and V_B which is essential for phase discrimination. An optimum value for the ratio R_2/R_1 can be found which gives the best differential action.

V_A will acquire a value such that the quantity of electricity which flows from C_2 through R_2 in the period of 1 cycle (2π radians) is exactly equal to the quantity of electricity supplied from the generators through the rectifier G_A for the period that the rectifier is conducting, namely $(\pi/2 - \phi)$ radians.

Hence:

$$\frac{V_1 - V_A}{R_1/2} \cdot (\pi/2 - \phi) = \frac{V_A}{R_2} \cdot 2\pi \quad .. \quad (6)$$

and

$$\frac{V_1 - V_B}{R_1/2} \cdot (\pi/2 + \phi) = \frac{V_B}{R_2} \cdot 2\pi \quad .. \quad (7)$$

Equations (6) and (7) may be rewritten:

$$V_A = V_1\left[\frac{(\pi/2 - \phi)}{(\pi/2 - \phi) + \pi \cdot R_1/R_2}\right] .. (8)$$

and

$$V_B = V_1\left[\frac{(\pi/2 + \phi)}{(\pi/2 + \phi) + \pi \cdot R_1/R_2}\right] .. (9)$$

From (8) and (9), we see that $V_A = V_B$ when $\phi = 0$, $V_A < V_B$ when ϕ is positive and $V_A > V_B$ when ϕ is negative. The most suitable value of R_1/R_2 is the one which gives the largest change in $V_A - V_B$ for a given small change in ϕ from $\phi = 0$.

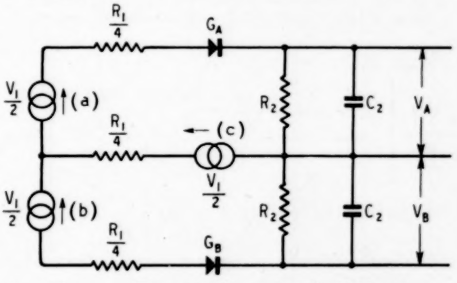


Fig. 12. The equivalent circuit of Fig. 9.

By differentiation this optimum is

$$\frac{dV_A}{d\phi} = V_1\left[\frac{-\pi \cdot \dfrac{R_1}{R_2}}{\left\{(\pi/2 - \phi) + \pi \cdot \dfrac{R_1}{R_2}\right\}^2}\right] .. (10)$$

$$\frac{dV_B}{d\phi} = V_1\left[\frac{\pi \cdot \dfrac{R_1}{R_2}}{\left\{(\pi/2 + \phi) + \pi \cdot \dfrac{R_1}{R_2}\right\}^2}\right] .. (11)$$

At $\phi = 0$

$$\left[\frac{d\,(V_A - V_B)}{d\phi}\right]_{\phi = 0} = -2\pi V_1\left[\frac{4\cdot\dfrac{R_1}{R_2}}{\pi^2\left(1+\dfrac{2R_1}{R_2}\right)^2}\right] = -\frac{8V_1}{\pi}\left[\frac{R_1/R_2}{(1+2R_1/R_2)^2}\right] \quad .. \quad (12)$$

We see that at $\phi = 0$ the differential sensitivity is a function of R_1/R_2. The value of R_1/R_2 for which the sensitivity is a maximum is given by the solution of

$$\left[\frac{\partial^2\,(V_A - V_B)}{\partial\phi\,\partial\,R_1/R_2}\right]_{\phi = 0} = 0$$

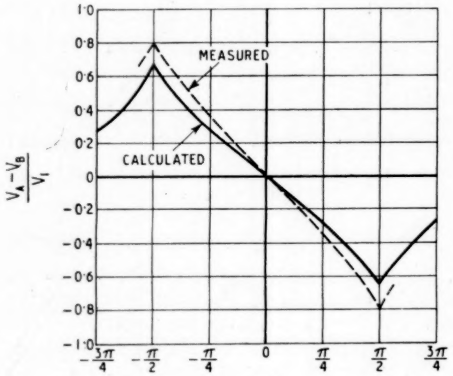


Fig. 13. Push-pull phase detector with square-wave input. Calculated and measured curves.

That is,

$$\frac{-8V_1}{\pi}\left[\frac{\left(1+2R_1/R_2\right)^2 - \dfrac{4R_1}{R_2}\left(1+\dfrac{2R_1}{R_2}\right)}{(1+2R_1/R_2)^4}\right] = 0$$

This is satisfied by $1 - 4\left(\frac{R_1}{R_2}\right)^2 = 0$

$$\text{or } R_2 = 2R_1 \quad .. \quad .. \quad .. \quad (13)$$

Substituting this condition in equations (8) and (9) we get:

$$\frac{V_A - V_B}{V_1} = \frac{\pi\phi}{\pi^2 - \phi^2} \quad .. \quad .. \quad (14)$$

This equation is plotted in Fig. 13 over the range of ϕ from $-\pi/2$ to $+\pi/2$ (equation (14) is strictly correct for this range only). On the same base is plotted the result obtained from measurements on a circuit similar to that of Fig. 9, with the following component values:—

$R_1 = 22{,}000$ ohms.
$R_2 = 47{,}000$ ohms.

The Balanced Push-Pull Phase Detector

(a) Theory for Sinusoidal Input.

We have shown that the simple push-pull phase detector, as in Fig. 6, is capable of detecting a phase difference by a difference in the two steady voltages V_A and V_B. Owing to the configuration of the circuit, neither V_A nor V_B can ever be negative (that is, the points A and B are always positive in potential relative to the centre point). When $\phi = 0$, $V_A = V_B$ and $V_C = 0$. The practical difficulties arising from the fact that V_A and V_B are voltages of considerable magnitude when $\phi = 0$, could be obviated by the circuit arrangement of Fig. 8. The same result may be achieved by the use of a balanced push-pull phase detector as shown in Fig. 14.

This arrangement is similar to that of Fig. 6 with the addition of the cross-connected rectifiers and resistors G_3, G_4 and R_1. From the symmetry of the circuit it will be evident that the voltages from the transformers T_1 and T_2, taken singly, cannot produce steady voltages V_A and V_B.

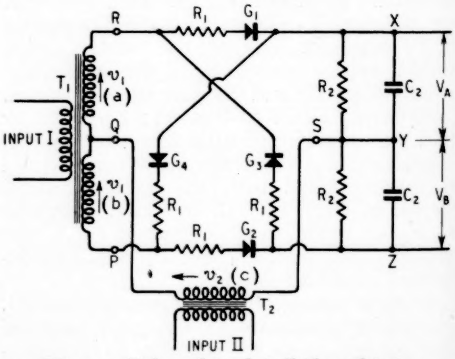


Fig. 14. Balanced push-pull phase detector.

The resultant charge on the capacitor C_2 between the points XY is provided by currents from the rectifiers G_1 and G_4 only, whilst the capacitor C_2 between YZ receives its charge from the rectifiers G_2 and G_3 only.

If we consider the capacitor between XY the relevant circuit may be re-drawn as in

Fig. 15; on the assumption that the generators driving the transformers T_1 and T_2 are of low internal impedance, the secondary windings *RQ*, *QP* and *QS* have been replaced in Fig. 15 by the equivalent generators of e.m.fs. $v_1\,(a)$, $v_1\,(b)$ and $v_2\,(c)$ respectively.

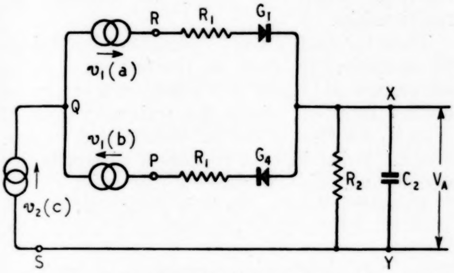


Fig. 15. Equivalent circuit of elements of Fig. 14 which produce V_A.

If we adopt the notation which has already been used we have

$$v_1\,(a) = v_1\,(b) = V_1 \sin \omega t.$$
$$v_2\,(c) = V_1 \sin (\omega t + \phi + \pi/2).$$

If the instantaneous voltage applied to rectifier G_1 is called V_{g1} and that applied to G_4 is V_{g4}, then

$$V_{g1} = v_2\,(c) + v_1\,(a)$$
$$V_{g4} = v_2\,(c) - v_1\,(b)$$

It is evident that current through G_1 makes X positive in potential relative to Y, and current through G_4 makes Y positive in potential relative to X.

From an inspection of Fig. 15 we may deduce the following:

(1) If $V_{g1} = V_{g4}$ the net charge accumulated by C_2 over each a.c. cycle is zero and hence $V_A = 0$.

(2) If V_{g1} is greater than V_{g4}, X becomes positive relative to Y.

(3) If V_{g4} is greater than V_{g1}, Y becomes positive relative to X.

Using our original notation we know that:

$V_{g1} = V_{g4}$ corresponds to $\phi = 0$.
$V_{g1} > V_{g4}$ corresponds to ϕ negative.
$V_{g1} < V_{g4}$ corresponds to ϕ positive.

Thus V_A changes sign as ϕ changes sign, and we see that the balanced push-pull circuit overcomes this limitation in the simple push-pull circuit, in which V_A and V_B are always positive and only the difference $(V_A - V_B)$ changes sign with ϕ.

In order to determine V_A we again make the assumption that V_A is substantially a constant unidirectional voltage over the period of one a.c. cycle.

In this case it implies that not only must the time constant $C_2 R_2$ be large compared with the period $2\pi/\omega$, but that $C_2 R_1$ must also be large, since C_2 effectively discharges through G_4 and R_1, or G_1 and R_1 depending on which of V_{g1} or V_{g4} respectively is the greater.

Let us consider the case when ϕ is negative. V_{g1} is greater than V_{g4} and V_A is positive. Thus G_1 will have a negative bias of V_A applied to its anode and G_4 will have a positive bias of V_A applied to its anode. Under these conditions G_1 will conduct for a period less than the positive half-cycle of the applied voltage V_{g1} and G_4 will conduct for a period greater than the positive half-cycle of V_{g4}. This is shown in Fig. 16 in which the phase equality between the waveforms of V_{g1} and V_{g4} is shown for convenience and has no significance.

From Fig. 16 we see that G_1 conducts for an angle $\theta_1/2$ on either side of the positive peak value of V_{g1} and G_4 conducts for an angle of $\theta_4/2$ on either side of the positive peak value of V_{g4}.

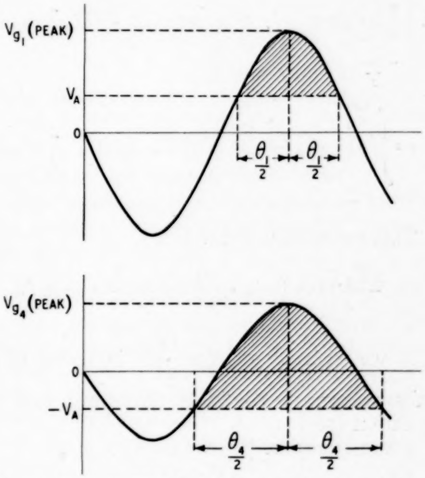


Fig. 16. Conduction angles of rectifiers G_1 and G_4.

Now,

$$\left.\begin{aligned} \frac{\theta_1}{2} &= \cos^{-1} \frac{V_A}{V_{g1}\,(\text{peak})} \\ \frac{\theta_4}{2} &= \left[\pi/2 + \sin^{-1} \frac{V_A}{V_{g4}\,(\text{peak})}\right] \end{aligned}\right\} \ldots (15)$$

Inserting the peak values of V_{g1} and V_{g4} from equation (2) we get:

$$\left.\begin{aligned}\cos\frac{\theta_1}{2} &= \frac{V_A}{|2V_1\cos(\pi/4+\phi/2)|}\\ \cos\frac{\theta_4}{2} &= \frac{-V_A}{|2V_1\sin(\pi/4+\phi/2)|}\end{aligned}\right\}\quad\ldots\qquad(16)$$

For a given value of ϕ, V_A will assume a steady value such that the quantity of electricity flowing through G_1 over the period θ_1 is equal to the quantity of electricity flowing through G_4 over the period θ_4 plus the quantity of electricity flowing through the resistance R_2 in one a.c. cycle (2π radians).

The plus sign applies to the case when V_{g1} is greater than V_{g4}. We may write therefore :—

$$\frac{1}{R_1}\int_{-\frac{\theta_1}{2}}^{+\frac{\theta_1}{2}}(V_{g1}-V_A)\,d\,(\omega t) = \frac{1}{R_1}\int_{-\frac{\theta_4}{2}}^{+\frac{\theta_4}{2}}(V_{g4}+V_A)\,d\,(\omega t) + \frac{2\pi V_A}{R_2}\quad\ldots\quad\ldots\qquad(17)$$

By making R_2 very much greater than R_1 we can ignore it in the following calculations.

$$\therefore\int_{-\frac{\theta_1}{2}}^{+\frac{\theta_1}{2}}\Big[\,2V_1\cos(\pi/4+\phi/2)\cos\omega t - V_A\Big]\,d(\omega t).$$

$$=\int_{-\frac{\theta_4}{2}}^{+\frac{\theta_4}{2}}\Big[2V_1\sin(\pi/4+\phi/2)\cos\omega t + V_A\Big]\,d(\omega t).$$

This expression reduces to,

$$\frac{2V_1}{V_A}\left[\cos\left(\pi/4+\phi/2\right)\sin\frac{\theta_1}{2} - \sin\left(\pi/4+\phi/2\right)\sin\frac{\theta_4}{2}\right] = \frac{\theta_1}{2}+\frac{\theta_4}{2}\quad\ldots\quad\ldots\qquad(18)$$

If we wish to express $\dfrac{V_A}{2V_1}$ in terms of ϕ only we must eliminate $\theta_1/2$ and $\theta_4/2$ in equation (18).

From equation (16) we have,

$$\left.\begin{aligned}\frac{\theta_1}{2} &= \cos^{-1}\,.\,\frac{V_A/2V_1}{\cos(\pi/4+\phi/2)}\\ \frac{\theta_4}{2} &= \pi/2+\sin^{-1}.\,\frac{V_A/2V_1}{\sin(\pi/4+\phi/2)}\end{aligned}\right\}\ldots\quad(19)$$

Thus equation (18) may be rewritten in terms of $V_A/2V_1$, and ϕ only, from which it should be possible to find $V_A/2V_1$ in terms of ϕ.

However, $V_A/2V_1$ is not expressed as an explicit function of ϕ and hence graphical methods must be used to obtain the relationship.

Thus for each value of ϕ chosen, both sides of equation (18) may be plotted for a series of values of $V_A/2V_1$. Where the pairs of curves intersect gives the unique values of $V_A/2V_1$ for the particular values of ϕ chosen. At one point in this process a discontinuity occurs and this will now be discussed.

Referring to Fig. 16 it is clear that as V_{g1} (peak) increases and V_{g4} (peak) decreases, a value of ϕ may be found at which V_{g4} (peak) $= V_A$. At this particular value of ϕ, $\theta_4/2 = \pi$ and for all values of ϕ lying between this value and the value which gives V_{g4} (peak) $= 0$, namely $\phi = -\pi/2$, $\theta_4/2$ will remain constant at the value π.

Let us find this critical value of ϕ.

We have, for $\theta_4/2$ just equal to π.

$$V_A = V_{g4}\text{ (peak)}$$

$$\therefore V_A = 2V_1\sin(\pi/4+\phi/2)$$

$$\text{or}\quad\frac{V_A}{2V_1} = \sin(\pi/4+\phi/2)$$

From equation (19)

$$\frac{\theta_1}{2} = \cos^{-1}\tan(\pi/4+\phi/2)$$

$$\text{or}\cos\frac{\theta_1}{2} = \tan(\pi/4+\phi/2)$$

$$\therefore\sin\frac{\theta_1}{2} = \sqrt{1-\tan^2(\pi/4+\phi/2)}$$

$$\left.\begin{aligned}\therefore\ \sin\frac{\theta_1}{2} &= \sqrt{1-\cos^2\frac{\theta_1}{2}} = \sqrt{1-\frac{(V_A/2V_1)^2}{\cos^2(\pi/4+\phi/2)}}\\ \text{and}\ \sin\frac{\theta_4}{2} &= \sqrt{1-\cos^2\frac{\theta_4}{2}} = \sqrt{1-\frac{(V_A/2V_1)^2}{\sin^2(\pi/4+\phi/2)}}\end{aligned}\right\}\quad\ldots\quad\ldots\qquad(20)$$

Substituting this in equation (18) and remembering that $\frac{\theta_4}{2} = \pi$ we have

$$\cot\left(\pi/4 + \phi/2\right)\sqrt{1 - \tan^2\left(\pi/4 + \phi/2\right)}$$
$$= \cos^{-1}\tan\left(\pi/4 + \phi/2\right) + \pi$$

$$\text{or } \sqrt{\cot^2\left(\pi/4 + \phi/2\right) - 1}$$
$$= \cos^{-1}\tan\left(\pi/4 + \phi/2\right) + \pi \quad .. \quad (21)$$

This gives a solution $\phi = -65.5°$.

Thus we use equation (18) as it stands for all values of ϕ from 0 to $-65.5°$, and we use the same equation with π substituted for $\theta_4/2$ for all values of ϕ between $-65.5°$ and $-90°$.

Using this graphical method the curve relating $V_A/2V_1$ with ϕ is plotted in Fig. 17 for values of ϕ from 0 to $-180°$; the curve for values of ϕ from 0° to $+180°$ is identical in shape but with negative values for $V_A/2V_1$.

The flat top to the curve, over the region $-70° > \phi > -110°$ also appears in the results obtained from measurements on this circuit, which are also plotted in Fig. 17.

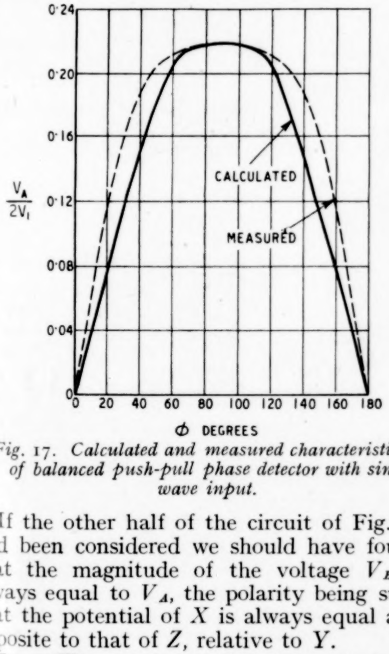


Fig. 17. *Calculated and measured characteristics of balanced push-pull phase detector with sine-wave input.*

If the other half of the circuit of Fig. 14 had been considered we should have found that the magnitude of the voltage V_B is always equal to V_A, the polarity being such that the potential of X is always equal and opposite to that of Z, relative to Y.

From Fig. 17 we see that the peak value of $V_A/2V_1$ is 0.218

$$\therefore \frac{V_A + V_B}{2V_1} = 0.436 \text{ (Maximum value).}$$

Comparing this value with that obtained from the simple push-pull circuit with sinusoidal input we see that the balanced push-pull circuit is less than 50 per cent as efficient as the former.

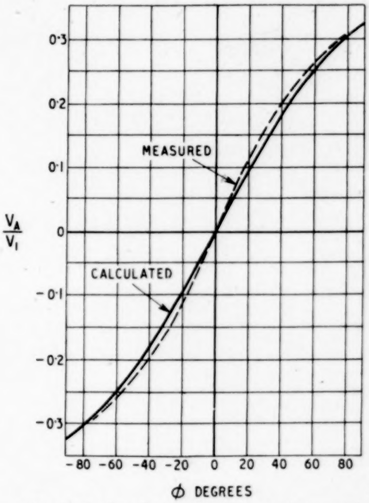


Fig. 18. *Calculated and measured characteristics of balanced push-pull phase detector with square-wave input.*

(b) *Theory for Square-Wave Input.*

By considering Figs. 11 and 15 we can find the result of applying rectangular waves to the circuit of Fig. 14.

If ϕ is negative, $\left(\frac{\pi}{2} - \phi\right)$ is greater than $(\pi/2 + \phi)$, and hence the time duration of the pulses applied to G_1 are greater than those applied to G_4. Hence the capacitor C_2 will acquire a steady voltage V_A such that X is positive in potential to Y.

If R_2 is very much greater than R_1, the voltage V_A must satisfy the following equation, taken over one complete cycle,

$$\frac{(V_1 - V_A)(\pi/2 - \phi)}{R_1}$$
$$= \frac{V_A\left(2\pi - \frac{\pi}{2} - \phi\right) + V_1(\pi/2 + \phi)}{R_1} \quad (22)$$

Which reduces to,

$$\frac{V_A}{V_1} = \frac{-\phi}{\pi - \phi} \quad .. \quad .. \quad .. \quad (23)$$

This equation is exact for values of ϕ from 0 to $-\pi/2$.

For values of ϕ from 0 to $\pi/2$, Y becomes positive in potential to X and the equation should read,

$$\frac{V_A}{V_1} = \frac{\phi}{\pi + \phi} \quad \ldots \quad \ldots \quad \ldots \quad (24)$$

The complete curve is shown in Fig. 18.

If the resistance R_2 is not so small that it may be neglected, equation (22) should be written,

$$\frac{(V_1 - V_A)(\pi/2 - \phi)}{R_1} = \frac{V_A(2\pi - \pi/2 - \phi) + V_1(\pi/2 + \phi)}{R_1} + \frac{2\pi V_A}{R_2} \quad \ldots (25)$$

which reduces to,

$$\frac{V_A}{V_1} = \frac{-\phi}{\pi(1 + R_1/R_2) - \phi} \quad \ldots \quad \ldots (26)$$

The measured response on a circuit made up with the values $R_1 = 5{,}000$ ohms and $R_2 = 22{,}000$ ohms is also plotted in Fig. 18.

Conclusion

The simple push-pull and the balanced push-pull phase detectors with sinusoidal and square-wave input have been analysed. Reviewing the results it would appear that for the overall requirements of sensitivity and a reasonably linear relation between phase difference and output, the simple push-pull detector with square-wave input gives the best result. The simple push-pull detector with sinusoidal input is more sensitive but the relationship between ϕ and the output voltage is sinusoidal, which may be undesirable.

REFERENCE

1. "Methods and Apparatus for Measuring Phase Distortion." M. Levy. *Electrical Communications*, Jan. 1940.

World List of Scientific Periodicals

A third edition of this reference book is being prepared to include all scientific and technical periodicals that have appeared from 1900 to 1947. Librarians are asked to co-operate by sending particulars of all journals which do not appear in the second edition to the Secretary, World List of Scientific Periodicals, c/o The Zoological Society of London, Regents Park, London, N.W.8.

BOOKS

Uber Frequenzmodulatoren für Ultrahochfrequenz.

By Georg Weber. Pp. 95 with 35 Figs. Published by Verlag AG. Gebr. Leemann & Co., Zürich. Price 9 Francs (Swiss).

This represents the thesis presented by the author for the D.Sc. degree at the Zürich Technische Hochschule. The work was carried out in the Institut für Hochfrequenztechnik under the direction of Dr. F. Tank. It deals with the difficulties of applying frequency modulation to transmitters working at frequencies of 100 to 600 Mc/s. Of the five chapters the first three discuss the problem and the last two describe the construction of apparatus and the measurements made with it. The relative merits of amplitude and frequency modulation are discussed in the opening chapter. The second chapter deals with the variable impedance valve, and the use of a klystron for this purpose. Chapter 3 is divided into two parts dealing with two different types of mechanical modulators, viz., piezoelectric and electrostatic modulators. The latter is then chosen and the remainder of the book describes in detail the construction and testing of an electrostatic frequency modulator. By means of the movement of a membrane the capacitance of a cavity resonator in the u.h.f. system is varied, thus causing the frequency to vary. The membrane is moved electrostatically by means of a metal plate parallel to it, the two forming an air capacitor, the voltage of which is varied by the modulating valve.

The results obtained are considered satisfactory. The question of distortion is discussed, and also the question as to the number of channels that can be utilized within a given frequency band in view of the large band of frequencies involved in a frequency-modulated transmission. The book is well worth careful study by anyone interested in this branch of the subject.

G. W. O. H.

The Magnetron

The object of this note is to draw attention to the April number of the *Bell System Technical Journal*, Vol. XXV, No. 2. Although published as a monthly issue of the Journal, it may well be regarded as a textbook on the magnetron, for it contains only one article, "The Magnetron as a Generator of Centimetre Waves." The authors are Fisk, Hagstrum, and Hartman, all of whom were engaged in the Electronics Research Department on magnetron development during the war. The article occupies 180 pages and has 80 figures, including many excellent photographs. Extra copies can be obtained at 1 dollar per copy from the American Telephone and Telegraph Co., 195 Broadway, New York. Although nominally the April number, circumstances delayed its publication until July. It is an outstanding publication, and it can be strongly recommended, notwithstanding the fact that the authors use the same abbreviation *m* for both milli- and mega-.

G. W. O. H.

CORRESPONDENCE

Letters of technical interest are always welcome. In publishing such communications the Editors do not necessarily endorse any technical or general statements which they may contain.

Response of Oscillator to External E.M.F.

To the Editor, " Wireless Engineer "

SIR,—In his article " Oscillator Power Relations " in the September 1946 issue of *Wireless Engineer*, Mr. R. E. Burgess includes a section discussing the response of an oscillator to an external e.m.f. injected into its circuit. The brevity of treatment of this section is such that I cannot myself fully follow it, and the section also seems irrelevant to the article; but these are personal matters. My present object is to point out what seems to me to be a fallacious argument; I suggest that it is not possible to consider the effective " half-power " bandwidth of the system, nor to express it in terms of a linear tuned circuit.

Mr. Burgess specifies the external (or injected) frequency to be different from the oscillation frequency. Yet he deduces the bandwidth between the points where the response is 3 db below that at midband, even though the response at midband (i.e., at the natural oscillation frequency) is specifically excluded from his analysis! Moreover, he specifies that the injected e.m.f. is small so that U (the voltage across the oscillator due to the injected frequency ω) is small compared with A (the voltage across the oscillator due to the free oscillation of frequency ω_0). This requirement appears to me to exclude consideration of any frequency near the " 3-db pass-band," because at any frequency so close to the natural frequency, the injected e.m.f. would need to be almost infinitesimal to avoid making U comparable with A.

No mention is made by Mr. Burgess of synchronization, the well-known phenomenon of suppression of the free oscillation by the forced oscillation. This occurs when $\omega \sim \omega_0$ is sufficiently small in relation to the amplitudes in the circuit. Mr. Burgess gives Appleton's paper[1] of 1922 as one of his references in spite of ignoring the effect in his text. This paper discusses some aspects of synchronization, and a more comprehensive treatment will be found in my own more recent paper.[2] This matter is vital to Mr. Burgess's problem, as I hope to show below.

Using the methods, results and symbols of my paper, in which

$\hat{e}_i \sin \omega t$ is the fundamental component of the forced oscillation voltage across the input to the non-linear maintaining circuit,

$\hat{e}_s \sin \omega t$ is the injected voltage,

$\hat{e}_{io} \sin \omega_0 t$ is the natural oscillation voltage with no injected signal,

$G(e_i)$ is the non-linear amplification of the maintaining circuit to fundamental frequencies,

and putting $\hat{e}_{im}$ for the peak amplitude of the forced oscillation when $\omega = \omega_0$ and using the subscript p for values associated with the pull-out point, or point of failure of synchronization, we can proceed as follows :—

If the injected voltage is small, then just at the point where synchronization is about to fail, and a free oscillation about to start, we have the relation

$$\frac{\hat{e}_{ip}}{\hat{e}_s} = \frac{1}{2Q\left(1 - \dfrac{\omega_p}{\omega_0}\right)}$$

and under such conditions, $\hat{e}_{ip}$ is only slightly smaller than $\hat{e}_{io}$.

When $\omega = \omega_0$, then $\hat{e}_i$ has the value of $\hat{e}_{im}$ and $\hat{e}_{im} > \hat{e}_{io}$ always. We have now the relation

$$\frac{\hat{e}_{im}}{\hat{e}_s} = \frac{1}{1 - G_m(e_i)}$$

where $G_m(e_i)$ is the gain of the maintaining circuit for the amplitude $\hat{e}_{im}$.

When free oscillation occurs in the absence of an injected signal, $G_o(e_i) = 1$, and since $\hat{e}_{im} > \hat{e}_{io}$ and the non-linearity must be such as to reduce the gain for an increased amplitude, we have $G_m(e_i) < 1$. Thus, for a given injected voltage $\hat{e}_s$, the change in response between frequencies ω_o and ω_p is given by

$$\frac{\hat{e}_{im}}{\hat{e}_{ip}} = \frac{2Q\left(1 - \dfrac{\omega_p}{\omega_o}\right)}{1 - G_m(e_i)}$$

This may be greater or less than 3 db according to the actual values of Q, $\hat{e}_s$ (which determines ω_p/ω_o), and $G(_{ei})$. In an average case it will be greater than 3 db; e.g., Fig. 11 in my paper shows that for $G(_{ei}) = 1.03 - 0.12\hat{e}_i^2$ (which gives $\hat{e}_{io} = 0.5$), $\hat{e}_s = 0.05$ and $Q = 80$, the output of forced oscillation at pull-out is approximately 4 db below that at " midband."

We can thus conclude that the 3-db bandwidth (if it has any meaning at all) will generally occur within the synchronizing frequency range, which is not discussed by Mr. Burgess, and is implicitly excluded from his analysis by his requirement $U \ll A$. Evidently the response cannot be expressed in terms of a fixed effective Q, because for a constant value of injected voltage, the forced oscillation amplitude varies with frequency, so that the non-linear factor (considered by Mr. Burgess as a parallel negative conductance) varies with frequency.

It is clear, I think, that Mr. Burgess's discussion is, to say the least, somewhat misleading, There is no opportunity to give the matter a full analysis on my part here, but I would claim that it is more readily treated by the methods used in my paper[2] than by Mr. Burgess's method.

Amersham, Bucks. D. G. TUCKER.

REFERENCES

1 E. V. Appleton, " The Automatic Synchronization of Valve Oscillators," *Proc. Camb. Phil. Soc.*, 1922–3, Vol. 21, p. 231–248.

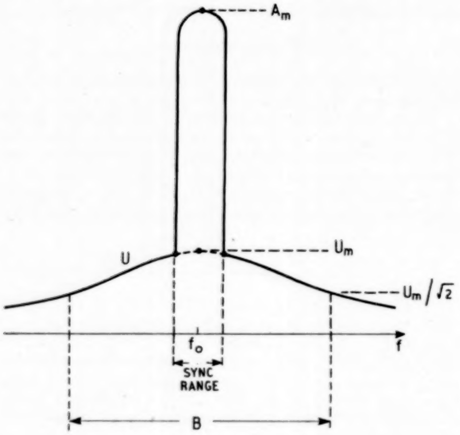
2 D. G. Tucker, " Forced Oscillations in Oscillator Circuits, and the Synchronization of Oscillators," *J.I.E.E.*, 1945, Vol. 92, Part III, p. 226–234.

To the Editor, " Wireless Engineer."

SIR,—Dr. Tucker's criticism springs from a misunderstanding which may well have arisen from the admitted brevity of section 6 of my paper.

The response curve defined by equation (19) relates the amplitude U of the forced oscillation to that of the injected e.m.f. E whose frequency is different from the oscillation frequency. It is specifically stated in my paper that E is sufficiently small for $U \ll A$ where A is the amplitude of the free oscillation and the synchronization range is correspondingly very small; ω is naturally assumed to lie *outside* the synchronization range in order that both the free and forced vibrations are present in the form given by equation (17).

The "3-db bandwidth" derived from equation (19) is referred to the value U_m obtained at f_0 by extrapolating the U, f curve through the synchronization range and *not* to the value A_m of the oscillation at f_0. The figure (not to scale) illustrates this point: B is reckoned between the points where $U = U_m/\sqrt{2}$ and not $A_m/\sqrt{2}$.



R. E. BURGESS.

National Physical Laboratory,
Teddington, Middx.

Transient Response of Filters.

To the Editor, "Wireless Engineer."

SIR,—I have read with interest Mr. C. C. Eaglesfield's short article on this subject in the November 1946 issue of *Wireless Engineer*, and am duly impressed by the neat and elegant way in which he solves the filter build-up equation which I found so difficult in my article in the March 1946 issue. I would like to point out, however, that I did give values for the coefficient G, based on the analogous low-pass filter, and these values were determined from exactly the same formula as Mr. Eaglesfield derives; this is easily seen from the figures I gave. My difficulty at this stage was that the calculated values did not fit the measured responses; and I suggested the reason was probably the effect of dissipation, since the Q-value of the inductors was only 100, which gives Qn (the factor affecting response, corresponding to Q in a low-pass filter—see my earlier article in the February 1945 issue) of only 3.7. I think Mr. Eaglesfield has rather overlooked the fact that I had dealt with these points.

D. G. TUCKER.

Amersham, Bucks.

Is Rotation Relative or Absolute?

To the Editor, "Wireless Engineer"

SIR,—In your editorial of the October issue, I found many controversial statements. They seemed to contradict entirely many experiences of the physical world. Therefore may I submit a few ideas on the subject "Is rotation relative or absolute"?

In order that we may possess a framework on which to build the argument it is necessary to state those things which we can regard as axiomatic.

1. The medium of events is "free space," which does not restrict those events.
2. An observer, in space, is capable of making time measurements.
3. The observer regards himself as stationary, when not acted upon by any force. If acted upon by a force he regards himself as moving with an acceleration in the direction of that force.
4. Distance is to be measured in absolute space.
5. A line is uniquely determined by two points in space.
6. The angle between two lines is to be regarded as some measure of the variation in distance between pairs of points on the lines, which are members of ordered aggregates of points in one-one correspondence, on these lines.

Having made these preliminary remarks, let us now consider what is meant by motion. The motion of a body infers change of position with time. To establish position we can erect two different systems of coordinates, either the Cartesian system or the polar system. To simplify the argument let us limit the discussion to a plane. Both these coordinate systems require two lines to establish the position of a point in a plane and therefore, in general require three points, including the datum point of the observer. In the case of polar coordinates, the position itself is regarded as one of the three points. In this last case, position is defined by the distance between the point and the pole, and the angle between the initial line and the line through the pole and the given point. Variation of either or both of these quantities with time will be sufficient to establish motion.

Let us now attempt a definition of rotation as applied to a finite body of zero thickness, in the plane of the coordinate system.

Suppose the observer at the datum point, draws a line across the body. He will note that this line makes different angles with the mean direction of the body as time progresses. Eventually by a series of observations he will determine the axis of rotation, which will seem to be stationary to him.

Having fixed this axis, the rotation of the body can be defined as a change in the angle between the line joining the datum point with the axis and the line joining the axis to any other point on the body, with time. Note that if no such point can be observed, the rotation of the body will not be visible.

Suppose now, the observer is fixed at the end of some extended radius of the body, which rotates. The observer will note that the angle subtended at the centre by every point is invariant with respect to time. He therefore concludes that the body is not rotating, although he is experiencing a force directed along the radius and towards the axis of rotation. He will conclude an acceleration towards the axis.

Now consider the case where the observer is situated at the axis of rotation. He will not be subject to any radial force. Unless there exists a point, external to the body, which is not subject to a radial force, he will not be able to erect the two lines by which rotation can be detected, since every two lines within the body will intersect at angles invariant with time. If however such an external point exists, the observer will conclude that it is rotating about him, by erecting a datum line on the body and another from himself to the external point.

We may therefore make the following generalizations:

(i) To any observer anywhere on the plane with relation to the axis of rotation of the body, the rotation will be detectable, provided the observer is not subject to the same radial force as he would be if he were attached to a fixed infinite radius of the body.

(ii) To any observer anywhere on the plane of the body, and "attached" to the radius of the body passing through his datum point, rotation will *not* be visible.

Therefore it is concluded that rotation is relative to the observer.

B. A. HUNN, Capt. R.E.M.E.

London, S.W.1.

To the Editor, The Wireless Engineer

SIR,—Your Editorial slyly shifts the absolute quality from the rotation of the body to the non-rotation of the observer. It is necessary to regard an observer who is " on " or " at rest relative to " a body as one whose sole frame of reference is in completely fixed relationship to the body in question; but you reject this definition in your footnote and adopt another definition which in fact makes the rotation of the cylinder become relative to the line joining the observer and the distant point on which he keeps his eye constantly fixed.

The fact which has some appearance of making the observer conscious of rotation is not the relative motion of certain points but the need for a constant force to maintain a central acceleration, just as with the revolving magnet the force on a neighbouring charge is the crucial issue. The trouble then is that a rotating body has an *acceleration*, and while we have become accustomed to the special theory of relativity, which applies to systems with constant relative velocity, transformations between systems having relative accelerations come under the general theory of relativity which is beyond the range of engineers' mathematics. However, it is concerned with this very problem of the invariance of forces when referred to different co-ordinate systems, and the general theory of relativity should not be ignored even if we do not understand its details.

D. A. BELL

London, N.21.

Class-B Amplifiers

To the Editor, The Wireless Engineer

SIR,—In your October correspondence columns Dr. Sturley has described an interesting method of calculating approximately the relation between the peak and mean currents in Class-B amplifier valves with sinusoidal grid excitation. The basic assumption in Dr. Sturley's analysis, namely, that the anode current becomes zero whenever the alternating component of the grid voltage becomes negative, may also be used to calculate approximately the peak and mean currents and the anode dissipation for grid voltages of arbitrary waveform, e.g. speech waves, if the crest factor, C (= peak/r.m.s.), and the form factor, F (= r.m.s./arithmetic mean), are known.

Let I_o = anode current in the absence of grid excitation

I_p = peak anode current with grid excitation

When the alternating grid voltage is positive the mean anode current is $I_o + (I_p - I_o)/CF$, and when the alternating grid voltage is negative the anode current is zero. It is further assumed that positive and negative values of grid voltage are equally probable. The mean anode current over both positive and negative values of grid voltage is then

$$I_a = I_o/2 + (I_p - I_o)/2CF$$

Suppose that two valves are used in a push-pull amplifier with an h.t. voltage V_a, and an anode-to-anode load which is a resistance R at all the frequencies concerned, and is zero for d.c. With grid excitation the peak current in the load is $I_p/2$, and the load-current waveform may be taken as a first approximation to be the same as the grid voltage waveform. Let V_{min} be the minimum value reached by the anode voltage, then $R = 4(V_a - V_{min})/I_p$, and the power absorbed by the load is $RI_p^2/4C^2$. The total power supplied by the h.t. source is $2V_aI_a$, whence the anode dissipation in each valve is

$$V_aI_a - RI_p^2/8C^2$$
$$= V_aI_o/2 + V_a(I_p - I_o)/2CF - I_p(V_a - V_{min})/2C^2.$$

For sine waves $C = \sqrt{2}$ and $F = \pi/2\sqrt{2}$. For speech waves $F = 2$. The value of C is somewhat indeterminate and may depend on the amount of peak limiting or permissible distortion, but a value of 5 may be taken as representative for most applications.

The formulae given above are approximate, and the accuracy decreases as the product CF increases, but they have been found useful in making the first attempt at a design.

A. S. G. GLADWIN

University of London,
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BRITISH I.R.E.

The 21st birthday of the British Institution of Radio Engineers was celebrated by a dinner at the Savoy Hotel on 31st October, 1946. Admiral the Viscount Mountbatten of Burma replied to the toast of the President proposed by the immediate past President, Mr. Leslie McMichael.

The Institution has grown out of the Institution of Wireless Technology which was formed in 1925, its present title being taken on the fusion of the original institution with the Institute of Radio Engineers in 1942.

Precision Instruments

A new catalogue of precision apparatus for electrical standards for research and industry has been produced by H. W. Sullivan, Ltd., London, S.E.15. Of 200 pages, it contains detailed descriptions and characteristics of apparatus ranging from fixed and variable standard capacitors and inductors to bridge and frequency-standard oscillators.

WIRELESS PATENTS

A Summary of Recently Accepted Specifications

The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each.

ACOUSTICS AND AUDIO-FREQUENCY CIRCUITS AND APPARATUS

577 333.—Spring guiding-member for clamping and controlling the vibration of a loudspeaker diaphragm.

D. Eklöv. Convention date (Sweden), 16th December, 1942.

577 358.—Loudspeaker in which the main diaphragm is coupled to an auxiliary system of elastically-mounted massive elements, to prevent resonance effects.

The British Thomson-Houston Co., Ltd. Convention date (U.S.A.), 7th January, 1943.

DIRECTIONAL AND NAVIGATIONAL SYSTEMS

577 242.—Radio installation for training operators on a grounded aeroplane in the art of radio-navigation and blind-landing.

Link Aviation Devices Inc. Convention date (U.S.A.) 29th April, 1942.

577 269.—Rotary-disc switching device for alternate transmission and reception, through waveguide couplings, say in radiolocation equipment

Marconi's W.T. Co. Ltd. (assignees of G. W. Leck). Convention date (U.S.A.) 25th May, 1943.

577 275.—Time-storage or integrating devices, used in combination with a c. r. tube, for reducing interference in the observation of " repetitive " signals, such as are used in radiolocation.

W. S. Percival. Application date 30th November, 1939.

577 276.—Blind-landing system in which a glide-path of constant field-strength approaches ground at a point remote from the transmitting aerials.

Standard Telephones and Cables Ltd., C. W. Earp and G. G. Samson. Application date 23rd February, 1940.

577 285.—Coupling network for transforming, without distortion, the output from the constantly-rotating search-coil of a radio goniometer to an amplifier feeding a c. r. indicator.

Standard Telephones and Cables Ltd. (assignees of H. G. Busignies). Convention date (U.S.A.) 6th March, 1941.

RECEIVING CIRCUITS AND APPARATUS

577 240.—Cathode-ray tube for monitoring, or indicating the beginning and end and operating-frequency, of one or more radio transmitters.

H. A. M. Clark. Application date 20th June, 1941.

577 247.—Diversity-reception system, for reducing the effect of selective fading, and applicable to frequency-modulation signals.

S. G. Dehn (communicated by Press Wireless Inc.). Application date, 13th April, 1944.

577 345.—Radio-operated switch for rendering a distant receiver active for predetermined periods, say for the remote control of firing apparatus.

D. Weighton and Pye Ltd. Application date 15th November, 1940.

577 443.—Radio set in which a rigid metal front panel is fitted with a pair of projecting rails, which can serve either as carrying-handles or as supporting-feet.

G. A. Laughton and H. N. Cox. Application date 27th April, 1944.

577 462.—Coupling network, say between two **i.f.** amplifiers, to provide a band-pass effect having an adjustable characteristic at frequencies near the middle of the band.

The General Electric Co. and D. C. Espley. Application date 21st May, 1943.

CONSTRUCTION OF ELECTRONIC-DISCHARGE DEVICES

577 278.—Electron-discharge device, for velocity-modulation, in which the bunched electrons are projected on to a secondary-emission electrode.

Standard Telephones and Cables Ltd., J. H. Fremlin, and R. N. Hall. Application date 24th May, 1940.

577 280.—Oscillator or frequency-changing device in which a beam of electrons is subjected to a wave-like deflection as it passes through a static magnetic-field.

The British Thomson-Houston Co. Ltd. Convention date (U.S.A.) 22nd December, 1939.

577 530.—Velocity-modulating tube in which the bunched stream is returned to the resonator along a potential gradient which is set up by a reflecting electrode-system.

A. F. Pearce, N. C. Barford, and B. J. Mayo. Application dates 16th December, 1941, and 13th January, 1943.

SUBSIDIARY APPARATUS AND MATERIALS

577 089.—Preparations of a fine-grain fluorescent material containing cadmium and manganese phosphate, and a mixture of chlorides and phosphates to serve as activators.

Siemens Electric Lamps and Supplies, Ltd. and H. Austin. Application date 24th April, 1944.

577 120.—Arrangement for time-marking, when making photographic records of oscillograph indications over a wide frequency-range.

A. C. Cossor, Ltd. and A. N. Melchior. Application date 19th April, 1944.

577 219.—Shrouded terminal, providing high insulation, particularly for feeding an element which is enclosed in an hermetically-sealed case.

Standard Telephones and Cables Ltd., P. K. Chatterjea, and S. J. Powers. Application date 11th February, 1944.

577 428.—Insulating coating, containing finely-divided anthracite coal, for reducing corona effects in high-voltage conductors.

Westinghouse Electric International Co. Convention date (U.S.A.) 3rd December, 1942.

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement
with the Department of Scientific and Industrial Research

In order to enhance the usefulness of the abstracts, certain changes have been made in their presentation. The subject sections have been increased in number and made more in accordance with the modern trend of development, and they are now arranged in alphabetical order. Universal Decimal Classification numbers have been added to each abstract, and heavy-face type has been adopted for the serial number and title in order to increase their legibility.

PAGE A.
Acoustics and Audio Frequencies 1
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ACOUSTICS AND AUDIO FREQUENCIES

534.851 : 621.395.625.2 **1**

On the Playback Loss in the Reproduction of Phonograph Records.—O. Kornei. (*J. Soc. Mot. Pict. Engrs,* Dec. 1941, Vol. 37, No. 6, pp. 569–590.) An analysis of the loss in the upper frequency range in reproducing lateral-cut records due to the elastic properties of the record material for the case of a spherically-pointed stylus. The playback loss (difference between recorded and reproduced level at any point) is independent of record amplitude and may be positive, zero or negative. The translation loss (difference between playback losses at two points) can only be made zero in systems with constant groove velocity; in standard recordings this is impossible, but the stylus mass can be chosen to give a compromise between translation loss and signal/noise ratio.

534.862 **2**

Multiple-Speaker Reproducing Systems for Motion Pictures.—H. I. Reiskind. (*J. Soc. Mot. Pict. Engrs,* Aug. 1941, Vol. 37, No. 2, pp. 154–163.) Systems employing extra loudspeakers outside the screen, while undesirable for dialogue, are advantageous for realistic reproduction of music and sound effects. A commercially practicable arrangement is described, in which a variable-width sprocket-hole control-track on the print is scanned by a simple photo-cell system, amplitude variations of the output of which control the operation and volume of the extra speakers. See also 3.

534.862 **3**

Vitasound [realistic cinema reproduction].—N. Levinson & L. T. Goldsmith. (*J. Soc. Mot. Pict. Engrs,* Aug. 1941, Vol. 37, No. 2, pp. 147–152.) A variable-width control track is printed in the sprocket-hole area of the standard film, and scanned by a separate photocell. This operates a variable-gain sound amplifier over a range of 10 db, and also a loudspeaker switching relay for extending the source of sound to loudspeakers beyond the screen. Both units have self-contained voltage-stabilised power supplies. The operating time of the control equipment is 60 ms, which is fast enough to deal with short duration effects. See also 2.

534.862 **4**

The Stereophonic Sound-Film System—General Theory.—H. Fletcher. (*J. Soc. Mot. Pict. Engrs,* Oct. 1941, Vol. 37, No. 4, pp. 331–352.) The ideal recording reproducing system for a typical hall is discussed. Intensity and frequency range curves are given. The modifications to these caused by room noises are considered in detail. Three-channel recording is used to give good representation of movement on a large stage and allows the use of the central channel for solo work if required. Reasons for variable area rather than variable density recording are given.

A volume range of 80 db has to be compressed to 50 db due to film limitation. Ideal relationships between signal input and compressor gain are deduced from signal/noise considerations to be constant gain for the first 50 db and gain inversely proportional to input for the remaining 30 db. The necessity for a pilot channel to control gain is demonstrated. The single pilot channel controls all three signal channels. Each signal channel is associated with a frequency from a magnetic tone-generator, the amplitude of which is controlled by the level of sound in that channel.

534.862 **5**

Mechanical and Optical Equipment for the Stereophonic Sound-Film System.—E. C. Wente, R. Biddulph, L. A. Elmer & A. B. Anderson.

(*J. Soc. Mot. Pict. Engrs*, Oct. 1941, Vol. 37, No. 4, pp. 353–365.) The same mechanical system is used for recording and reproduction. Special care is taken to ensure uniform film velocity by using a new type of internally-damped roller.

The 3 signal and the pilot channels are recorded simultaneously by light valves. During reproduction the light is guided to the photocells by glass rods.

534.862 **6**

Fantasound [stereophonic system used in " Fantasia "].—W. E. Garity & J. N. A. Hawkins. (*J. Soc. Mot. Pict. Engrs*, Aug. 1941, Vol. 37, No. 2, pp. 127–146.) The system uses three sound tracks and a control track carrying three tones which vary the gains of the three programme channels. A differential junction network is used for giving apparent motion of a sound source across the screen. Ten versions of the system are described in historical order of development. The technique of scoring and dubbing is also described.

534.862 : 621.395.665 **7**

An Improved Mixer Potentiometer.—K. B. Lambert. (*J. Soc. Mot. Pict. Engrs*, Sept. 1941, Vol. 37, No. 3, pp. 283–288, Discussion, pp. 289–291.) A mixer comprising five plug-in units of two mixer controls each. The mixer potentiometer controls move linearly, in parallel grooves, so that all ten can be handled simultaneously by one operator. Incoming channels, attenuated as desired (over a range of 6–105 db) by the potentiometers are combined by special transformers in groups of four, into an output having the same impedance as each (200Ω). The potentiometers are continuously wire-wound, and themselves have approximately constant input and output impedances of 200Ω. Internal crosstalk between channels is less than -110 db.

534.862.3 : 621.395.625.6 **8**

A Light-Valve for the Stereophonic Sound-Film System.—E. C. Wente & R. Biddulph. (*J. Soc. Mot. Pict. Engrs*, Oct. 1941, Vol. 37, No. 4, pp. 397–405.) The theory of light valves for sound recording on film is discussed and a mechanically robust design described. A pair of coplanar duralumin ribbons 0.004 inch apart are supported in a transverse magnetic field of 32 000 Gauss in the air gap between the conical pole pieces of a permanent magnet. The ribbons form a light slit which varies in size in accordance with the current flowing through them. The chief problem is to obtain uniform response over a wide frequency range including the resonant frequency, since a value of this above the working range would involve impracticable ribbon tension and dimensions. In this case the resonant frequency is 8 400 c/s, and the response/frequency characteristic has a broad maximum around 8 000 c/s, 5 db above the response at low frequencies. Uniform overall response in the band 30–14 000 c/s is obtained by suitable electrical networks. Large electromagnetic damping of the ribbons is used to assist in this and also to minimise the effect of free oscillations at the resonant frequency, produced by the ribbons striking each other. The built-in optical system consists of a condensing lens focusing the light source in the plane of the ribbons, and a microscope objective focusing the ribbons on the film.

534.862.3 : 621.395.665.1 **9**

Electrical Equipment for the Stereophonic Sound-Film System.—W. B. Snow & A. R. Soffel. (*J. Soc. Mot. Pict. Engrs*, Oct. 1941, Vol. 37, No. 4, pp. 380–395, Discussion pp. 395–396.) For the recording of symphonic music. Film noise reduced by pre-equalisation rising to 18 db above 8 000 c/s, and automatic compression and expansion of 30 db. Overall " air-to-air " response of system including microphone amplifier and loudspeaker is substantially uniform from 40 to 15 000 c/s. The compandor system has a uniform frequency characteristic and is pilot-operated by a tone channel.

534.862 : 621.396.665.1 **10**

The Stereophonic Sound-Film System—Pre- and Post-Equalization of Compandor Systems.—J. C. Steinberg. (*J. Soc. Mot. Pict. Engrs*, Oct. 1941, Vol. 37, No. 4, pp. 366–379.) Curves give as a function of frequency the reduction in film noise that is required to reproduce the original intensity range. This is greatest at the higher frequencies where 43 db improvement in signal/noise is required. The use of a suitable equaliser reduces this figure to a maximum of 30 db, which is within the range of a compandor, even with a 15 db " enhancement " feature. The practical performance of the compandor is given, with the results of its use in conjunction with equalisers..

621.314.2 **11**

High-Quality Communication and Power Transformers.—Harrison. (*See* 201.)

621.317.353 **12**

A Simple Method of Measuring Distortion in A.F. Oscillators and Amplifiers.—Smith. (*See* 117.)

621.395.47 **13**

Inverted Speech.—A. W. Ladner. (*Marconi Rev.*, Jan./Mar. 1945, Vol. 8, No. 76, pp. 32–35.) Second part of an article dealing with the relationship of inverted speech to ordinary articulatory sounds. Tests are described in which single-syllable words were inverted at 1 500 c/s and recognition by a group of listeners examined. The majority of vowels and consonants become unrecognisable on inversion and the reason for this is illustrated in terms of the energy/frequency spectrum. For first part see 78 of 1945.

621.395.614 **14**

Piezo-Electric Microphones.—W. T. C. (*Wireless World*, Nov. 1945, Vol. 51, No. 11, pp. 345–346.) If mounted in a light-weight container the piezo-electric microphone is very sensitive to noise caused by handling and vibration, and exhibits large resonances. The article shows the design of a heavy metal case in which the performance is greatly improved.

621.395.623 **15**

High-Fidelity Headphones.—L. J. Anderson. (*J. Soc. Mot. Pict. Engrs*, Sept. 1941, Vol. 37, No. 3, pp. 319–323.) The acoustic properties of the moving-coil earpieces are treated in terms of the equivalent electrical circuit. Low-frequency response is improved by the reduction of leakage past the ear-cap as revealed by a smoke test, as well as by adjusting circuit constants. Mechanical requirements are considered and performance curves given.

621.395.623.7 **16**

The Duplex Loudspeaker.—J. B. Lansing. (*J. Soc. Mot. Pict. Engrs*, Sept. 1944, Vol. 43, No. 3, pp. 168–173.) A two-way loudspeaker for 25 W input with a high-frequency horn mounted on the face of the low-frequency diaphragm. Dividing networks are given for cross-over at 1 200 c/s. Gives efficient radiation beyond 15 000 c/s with low intermodulation products. High-frequency horn has an angle of radiation of 60° horizontally and 40° vertically.

621.395.623.8 **17**

Acoustic Feedback Reduction by Increased Directivity in Electric Megaphones.—A. J. Sanial. (*Communications*, Sept. 1945, Vol. 25, No. 9, pp. 62–64.) Acoustic feedback from loudspeaker to microphone is reduced by partially focusing the sound by means of a ring exit surrounded by a slightly divergent outer horn, with an inner plug. Some three times increase in pressure-output over the annular horn has been obtained. A continuation of 3556 of 1945.

621.395.625 : 621 **18**

It Pays to Listen.—(*Sci. Amer.*, July 1945, Vol. 173, No. 1, pp. 18–20.) Imperfections in running machinery can often be detected by a change in the characteristic noise earlier than by any other method. With modern quiet-running machinery the sounds can be amplified and recorded, and compared at any time with a standard recording made when the machinery was running well.

621.395.625.2 + 621.395.625.6 **19**

Western Electric Recording System—U.S. Naval Photographic Science Laboratory.—R. O. Strock & E. A. Dickinson. (*J. Soc. Mot. Pict. Engrs*, Dec. 1944, Vol. 43, No. 6, pp. 379–404.) A general technical description of a commercial recording and re-recording equipment using film and disk. Improved designs for ease of operation and servicing.

621.395.625.2 **20**

Glossary of Disk-Recording Terms.—H. A. Chinn. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 760–763.) About 120 terms, all pertaining to constant-rotational-speed disc recording.

621.395.625.2 **21**

Analytic Treatment of Tracking Error and Notes on Optimal Pick-Up Design.—H. G. Baerwald. (*J. Soc. Mot. Pict. Engrs*, Dec. 1941, Vol. 37, No. 6, pp. 591–622.) An analysis of the non-linear distortions due to tracking error in the reproduction of lateral-cut disc recordings. For a sinusoidal signal the analysis is the same as that arising in Bessel's solution of planetary motion. The harmonic distortion for both sinusoidal and complex signals is discussed. The emphasis of the high-frequency components increases the nuisance value of the distortion, which is greater than is commonly assumed.

Pick-up design for minimum tracking distortion over the whole playing range is considered. In straight arms the underhang is adjustable, while in offset arms the offset angle and overhang are adjustable and they are superior to straight arms, enabling tracking distortion to be rendered negligible even under adverse conditions.

621.395.625.6 **22**

A Re-Recording Console, Associated Circuits, and Constant B Equalizers.—W. C. Miller & H. R. Kimball. (*J. Soc. Mot. Pict. Engrs*, Sept. 1944, Vol. 43, No. 3, pp. 187–205.) Metro Goldwyn Mayer studio equipment with constant resistance multi-channel mixing transformers and variable equaliser circuits. Design formulae are given for a bridged-T equaliser network having adjustable resonant frequency with variable loss or gain at that frequency.

621.395.625.6 **23**

A New Mobile [film sound] **Recording Unit for Studio and Location Work.**—J. L. Fields. (*J. Soc. Mot. Pict. Engrs*, July 1944, Vol. 43, No. 1, pp. 51–58.) A battery-operated unit for a medium-sized van. Aisle-type construction permits flexibility in arrangement of apparatus.

621.395.625.6 **24**

Noise-reduction Anticipation Circuits.—J. G. Frayne. (*J. Soc. Mot. Pict. Engrs*, Nov. 1944, Vol. 43, No. 5, pp. 313–320.) The mean illumination in recording a film sound track is controlled by the output from a microphone placed 10 ft. nearer the sound source than the recording microphone. For re-recording a wax record is used with the pick-up advanced in the groove.

621.395.625.6 **25**

An AAF Portable Sound Recording Unit.—F. T. Dyke. (*J. Soc. Mot. Pict. Engrs*, Nov. 1944, Vol. 43, No. 5, pp. 327–333.) An outline of a commercial equipment suitable for a.c. mains or 36 V battery operation, easily carried in a small vehicle.

621.395.667 **26**

"A New Versatile Tone Control Circuit."—D. Winget. (*Wireless World*, June 1945, Vol. 51, No. 6, p. 182.) A modification of the circuit given in 1840 of 1945.

AERIALS AND TRANSMISSION LINES

621.315.212.1 : 621.317.33 **27**

Coaxial Cable Tests.—Ware. (*See* 114.)

621.315.616 : 621.315.212 **28**

Polyethylene-Disk Insulators for Coaxials.—C. Kreisher. (*Bell Lab. Rec.*, Sept. 1945, Vol. 23, No. 9, pp. 321–324.) The replacement of hard rubber disk insulators in coaxial cables by polyethylene has reduced losses to one-twelfth at frequencies of the order of 1 Mc/s. The manufacturing technique has been slightly modified to suit the newer dielectric.

621.316.99 **29**

Grounding Principles and Practice, I.—Fundamental Considerations on Ground Currents.—R. Rüdenberg. (*Elect. Engng*, Jan. 1945, Vol. 64, No. 1, pp. 1–13.) An analysis of the behaviour of earth currents as influenced by soil resistivity, current frequency, and size and shape of the electrodes. Parts II-V of this five-part series appear in the February-May issues of *Elect. Engng*, and deal with power-engineering aspects of the subject of grounding.

621.392 **30**

The Plane-Wave Resolution of Guided Waves.—S. S. Mackeown & J. W. Miles. (*Proc. Inst. Radio

Engrs, N.Y., Nov. 1945, Vol. 33, No. 11, pp. 805–808.) "Wave propagation in cylindrical guides of both rectangular and circular cross section is treated by representing the proper solutions to Maxwell's equation through a plane-wave expansion of the Hertzian vector. In the case of a rectangular wave guide only a finite number of plane waves (two or four) is required to represent a given mode, while for the circular guide an infinite manifold is required. The plane waves are uniform, travelling with the velocity of light in the medium at an angle to the cylindrical axis which is determined by the frequency and the eigen value of the mode under consideration."

621.392 **31**

The Theory of Transmission Lines.—E. N. Dingley, Jr. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 810–812.) Discussion on 1748 of 1945.

621.392 **32**

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621.396.67 **33**

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621.396.676.029.54 **34**

Aerials for use on Aircraft: a Comparison between Fixed and Trailing Types on the 900-metre Waveband.—C. B. Bovill. (*J. Instn elect. Engrs*, Part I, Oct. 1945, Vol. 92, No. 58, pp. 397–398.) Summary of 3294 of 1945.

621.396.676.029.62 **35**

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621.396.677 **36**

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CIRCUITS

621.3.011 **37**

The Extended Employment of Thévenin's Theorem.—A. Lee & D. K. C. MacDonald. (*Wireless Engr*, Nov. 1945, Vol. 22, No. 266, pp. 534–537.) Some mathematical examples to show how the theorem can be applied to problems containing transient phenomena.

621.3.011.2 : 621.3.012.3 **38**

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621.314.12 : 621.383 **39**

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621.314.3 : 578.088.7 : 621.396.822 **44**

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effect increases as frequency is reduced and is immensely greater in coated cathode valves. Writer suggests the use of tungsten filament valves in the first stage of biological amplifiers.

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621.314.3 : 623.6 **46**

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621.316.313 **47**

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621.316.721.078.3 **48**

Analysis of Current-Stabilizer Circuits.—W. R. Hill, Jr. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 785–792.) "The performance of any current stabilizer can be predicted in terms of two parameters defined as the stabilization transconductance, g_s, and the output conductance, g_o. Together with the equivalent circuits of Figs. 2 and 3 these two factors permit the calculation of the stabilizer performance in conjunction with any load circuit and direct-current supply. Fundamental stabilizer circuits based on the degenerative and mu-bridge principles are developed and analyzed for the two parameters defined. For simple circuits, the analysis suggests the use of pentodes to obtain best stabilization. Superior performance can be obtained by the mu-balance circuit described. This circuit provides an output current substantially independent of any input-voltage or load-circuit change."

621.317.372 : 621.319.4 **49**

Determining Q of Capacitors.—E. L. Pepperberg. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 146, 148.) A chart is given, with a simple calculating procedure whereby the Q of any capacitor may easily be determined from measurement with an ordinary laboratory Q meter.

621.318.572 **50**

Electronic Counting.—M. Weber. (*Communications*, Aug. 1945, Vol. 25, No. 8, pp. 42..98.) A description of a circuit for counting pulses or dividing a frequency. Two condensers and two diodes are connected in such a way that each pulse increases the charge on one of the condensers (see 3961 of 1940). When the potential difference between the condenser terminals reaches a predetermined value a triode blocking-oscillator circuit is triggered, resulting in the production of an output pulse and in the discharge of the condenser. Irregularly-spaced pulses of the same peak amplitude but with different width or shape can be counted, and pulses of irregular amplitude can be counted if a voltage-limiter circuit is used before the counter. A maximum of ten input pulses per output pulse is recommended.

621.318.7 + 621.392.52 **51**

Crystal Filters, Part IV.—R. L. Corke. (*P.O. elect. Engrs' J.*, Oct. 1945, Vol. 38, Part 3, pp. 76–81.) Examples are given of a simple filter with narrow band-pass (0.3%), a lattice filter with wider band-pass (0.6%), and a bridged-T filter suitable for the i.f. section of a receiver. A channel filter of 3 kc/s band-pass and a through-group filter passing frequencies from 60 to 108 kc/s are described. For previous parts see 2930 and 3497 of 1945.

621.318.72 **52**

Abacs for Filter Design.—T. Roddam. (*Wireless World*, Nov. 1945, Vol. 51, No. 11, pp. 332–334.) Two full-page charts from which the values of inductance and capacitance required to design low-pass constant-k,-π or-T section filters can be obtained. The first of a series.

621.385.012.8 **53**

Valve Vectors.—R. G. Wood: D. A. Bell. (*Wireless Engr*, Nov. 1945, Vol. 22, No. 266, pp. 532–533.) Continuation of correspondence on sign conventions. See also 3272 and 3504 of 1945.

621.392 : 621.3.011.2 **54**

Stabilized Negative Impedances—Part III.—E. L. Ginzton. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 140–144.) Applications of negative impedances are described. Elimination of distortion in a diode rectifier can be effected by insertion of a negative resistance shunted across the diode load, the value of this negative resistance being equal to the difference between the impedance offered by the diode output at the modulation frequency and that offered to a d.c. potential difference. Means are also described for eliminating the series resistance of capacitors, producing very large capacitance for power-supply filtering, increasing the Q of tuned circuits, and regulating power supplies. For previous parts see 3268 and 3842 of 1945.

621.392.5/.6 **55**

The Application of the Characteristic Equation of a Matrix to the Evaluation of the Range of Frequencies for which Currents are passed through Networks with Four or More Terminals without Attenuation.—H. V. Lowry. (*Phil. Mag.*, April 1945, Vol. 36, No. 255, pp. 255–264.)

621.392.52 **56**

Effect of Coil Q on Filter Performance.—P. Selgin. (*Communications*, Sept. 1945, Vol. 25, No. 9, pp. 46..106.) Two full-page universal charts from which values of filter components can be obtained. A worked example illustrates the method. See also 3499 of 1945.

Engrs, N.Y., Nov. 1945, Vol. 33, No. 11, pp. 805–808.) "Wave propagation in cylindrical guides of both rectangular and circular cross section is treated by representing the proper solutions to Maxwell's equation through a plane-wave expansion of the Hertzian vector. In the case of a rectangular wave guide only a finite number of plane waves (two or four) is required to represent a given mode, while for the circular guide an infinite manifold is required. The plane waves are uniform, travelling with the velocity of light in the medium at an angle to the cylindrical axis which is determined by the frequency and the eigen value of the mode under consideration."

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621.396.676.029.62 **35**

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CIRCUITS

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Determining Q of Capacitors.—E. L. Pepperberg. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 146, 148.) A chart is given, with a simple calculating procedure whereby the Q of any capacitor may easily be determined from measurement with an ordinary laboratory Q meter.

621.318.572 **50**

Electronic Counting.—M. Weber. (*Communications*, Aug. 1945, Vol. 25, No. 8, pp. 42..98.) A description of a circuit for counting pulses or dividing a frequency. Two condensers and two diodes are connected in such a way that each pulse increases the charge on one of the condensers (see 3961 of 1940). When the potential difference between the condenser terminals reaches a predetermined value a triode blocking-oscillator circuit is triggered, resulting in the production of an output pulse and in the discharge of the condenser. Irregularly-spaced pulses of the same peak amplitude but with different width or shape can be counted, and pulses of irregular amplitude can be counted if a voltage-limiter circuit is used before the counter. A maximum of ten input pulses per output pulse is recommended.

621.318.7 + 621.392.52 **51**

Crystal Filters, Part IV.—R. L. Corke. (*P.O. elect. Engrs' J.*, Oct. 1945, Vol. 38, Part 3, pp. 76–81.) Examples are given of a simple filter with narrow band-pass (0.3%), a lattice filter with wider band-pass (0.6%), and a bridged-T filter suitable for the i.f. section of a receiver. A channel filter of 3 kc/s band-pass and a through-group filter passing frequencies from 60 to 108 kc/s are described. For previous parts see 2930 and 3497 of 1945.

621.318.72 **52**

Abacs for Filter Design.—T. Roddam. (*Wireless World*, Nov. 1945, Vol. 51, No. 11, pp. 332–334.) Two full-page charts from which the values of inductance and capacitance required to design low-pass constant-k,-π or-T section filters can be obtained. The first of a series.

621.385.012.8 **53**

Valve Vectors.—R. G. Wood : D. A. Bell. (*Wireless Engr*, Nov. 1945, Vol. 22, No. 266, pp. 532–533.) Continuation of correspondence on sign conventions. See also 3272 and 3504 of 1945.

621.392 : 621.3.011.2 **54**

Stabilized Negative Impedances—Part III.—E. L. Ginzton. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 140–144.) Applications of negative impedances are described. Elimination of distortion in a diode rectifier can be effected by insertion of a negative resistance shunted across the diode load, the value of this negative resistance being equal to the difference between the impedance offered by the diode output at the modulation frequency and that offered to a d.c. potential difference. Means are also described for eliminating the series resistance of capacitors, producing very large capacitance for power-supply filtering, increasing the Q of tuned circuits, and regulating power supplies. For previous parts see 3268 and 3842 of 1945.

621.392.5/.6 **55**

The Application of the Characteristic Equation of a Matrix to the Evaluation of the Range of Frequencies for which Currents are passed through Networks with Four or More Terminals without Attenuation.—H. V. Lowry. (*Phil. Mag.*, April 1945, Vol. 36, No. 255, pp. 255–264.)

621.392.52 **56**

Effect of Coil Q on Filter Performance.—P. Selgin. (*Communications*, Sept. 1945, Vol. 25, No. 9, pp. 46..106.) Two full-page universal charts from which values of filter components can be obtained. A worked example illustrates the method. See also 3499 of 1945.

621.395.625.6 **57**

A Re-Recording Console, Associated Circuits, and Constant B Equalizers.—Miller & Kimball. (*See* 22.)

621.395.625.6 **58**

Noise-Reduction Anticipation Circuits.—Frayne. (*See* 24.)

621.395.645.211 : 621.395.645.33 **59**

The Resistance-Coupled Amplifier.—L. G. Cowles. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, June Supplement 1945, Vol. 64, pp. 359–365.) "The routine problems of resistance-coupled amplifier design have been simplified and reduced to a set of graphs and convenient conversion charts.

". . . the coupling circuit can be replaced by a pair of equivalent resistance-capacitance circuits so that it is easy to calculate an amplifier's phase and amplitude-frequency characteristics. The design of a coupling circuit to give a specified band width and an acceptable loss has been simplified by the construction of curves of constant band width and peak-frequency loss.

". . . a method and charts are presented for determining without the use of static characteristic curves a suitable operating point, electrode voltages, and plate or screen resistors for any vacuum tube operated class A. As the method given results in the tube being operated with proportionally reduced electrode voltages, its dynamic constants can be extrapolated from values furnished by the manufacturer. Charts facilitating the extrapolation are given.

"A simple transconductance meter for measuring the mutual conductance and circuit transconductance of a tube operated with an external plate resistor is described . . . The gain of the tube and the equivalent plate-circuit resistance can be calculated easily from these two measurements. The dynamic constants μ and r_p can be obtained also with an accuracy sufficient for most practical purposes.

"The methods outlined . . . have proved to be thoroughly practical and reliable in work on a wide variety of resistance-coupled amplifiers."

621.395.665 **60**

Resistive Attenuators, Pads and Networks: Part VIII.—P. B. Wright. (*Communications*, Sept. 1945, Vol. 25, No. 9, pp. 68..80.) An analysis of the series-parallel-connected and of the parallel-series-connected multiple-bridge and lattice-network fader and mixer systems. For previous parts see 2178, 3501 and 3821 of 1945.

621.395.667 **61**

"A New Versatile Tone Control Circuit."—D. Winget. (*Wireless World*, June 1945, Vol. 51, No. 6, p. 182.) A modification of the circuit given in 1840 of 1945.

621.396.615.17 : 621.318.572 **62**

Timing Action of the Blocking Oscillator.—E. Last. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 184..204.) A very full and detailed description of the blocking (or squegging) oscillator, as applied to timing and trigger circuits, and of the means of controlling the characteristics of the output. A two-page article.

621.396.616 **63**

Transmission Lines as Tuning Elements.—H. E. Newell, Jr. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 150, 152.) Describes the theory, construction, and use of a graph for designing a tuning element consisting of a section of transmission line shunted by a capacitor. Values of one or two unknown circuit parameters may be found when values of two or three others are known.

621.396.619 : 621.396.615.17 **64**

Square-Wave [pulse] **Modulator for Signal Generator.**—W. R. Piggott. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 260..268.) Summary of 1536 of 1945.

621.396.66 **65**

Automatic Fader.—D. Hunter. (*Electronics*, Oct. 1945, Vol. 18, No. 10, p. 119.) A description, in very technical language, of a device which automatically fades a broadcast programme in or out, completely or partially, at predetermined rates, without the use of motors. The fading time is adjustable from 1 to 15 seconds, by variation of a time-delayed bias on an amplifier. It operates from "the nemo and announce tally iights plus an installed fade key and tally".

621.396.662.2.029.62 **66**

Coil Design for V.H.F.—A. H. Meyerson. (*Communications*, Sept. 1945, Vol. 25, No. 9, pp. 50..84.) The results of experiments to determine the best coil shape for use at 60–120 Mc/s are given graphically and in tabular form. Coils constructed of round wire, tube, strip, and in disc form were measured and the disc form was found to have the best stability while maintaining a good Q. Single-turn coils of round copper tube had the highest Q, which varied somewhat with tube diameter, but at the highest frequencies the variations between tube and disc type were not significant.

621.397.62 **67**

Restorer-Circuit Operation.—E. Last. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 132–133.) A restorer circuit is a device which shifts the abscissa of an input voltage wave of any form. In a negative restorer a square wave input from 0 to $+E$ volts will appear as an identical wave from $-E$ to 0 volts; in a positive restorer a wave input from $+E/2$ to $-E/2$ may be made to appear as a wave from 0 to $+E$ volts. Biased restoration from $-(E + E_b)$ to $-E_b$ is also possible. The circuits for such devices are described.

621.397.645.31 **68**

Carrier-Frequency Amplifiers: the Unit Step Response of Amplifiers with Single and Double Circuits.—C. C. Eaglesfield. (*Wireless Engr*, Nov. 1945, Vol. 22, No. 266, pp. 523–532.) A mathematical comparison, using Heaviside's operational method, between two amplifiers, one having staggered single circuits and the other double circuits, with a view to finding which has the greater "speed". For the sake of comparison the two amplifiers have the same "overshoot" (see 2283 of 1945). For applications such as in television the two methods are equally effective.

621.3.01/.02 **69**

Elementary Electric Circuit Theory [Book Review].—R. H. Frazier. McGraw-Hill, N.Y., 1945, 414 pp., $4.00. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 428..430.) " . . . intended as a text for electrical engineers who have completed fundamental physics and mathematical courses." " A broad viewpoint of lumped constant circuits . . . written for a first course in circuits."

GENERAL PHYSICS

538.3 **70**

The Application of Newton's Third Law to an Electric Circuit.—G.W.O.H. (*Wireless Engr*, Nov. 1945, Vol. 22, No. 266, pp. 521–522.) The Biot-Savart formula is not a violation of Newton's third law. Analysis of a long, narrow, rectangular loop carrying a steady current illustrates " the fallacy of endowing with separate physical reality the forces on current elements due to other current elements and then discussing whether or not they violate Newton's third law ".

538.3 : 531.51 **71**

A Classical Theory of Electromagnetism and Gravitation.—H. C. Corben. (*Nature, Lond.*, 29th Sept. 1945, Vol. 156, No. 3961, pp. 388–389.)

621.38 **72**

Electronics.—S. R. Cook. (*Sci. Mon., N.Y.*, Aug. 1945, Vol. 61, No. 2, p. 163.) A letter questioning some of the ideas expressed in 3752 of 1945 (Mills).

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.165 + 537.591 **73**

The Composition of the Soft Component of the Cosmic Rays at an Altitude of 3250 m above Sea Level.—A. Alichanow & A. Alichanian. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 2, pp. 73–86.) Cosmic ray measurements by means of counters and ionisation chambers showed a systematic difference between the data obtained by the two methods. " This is due to the presence in the soft component of particles with ionization power exceeding that of the relativistic particles 2.5 to 3.5 times. It is shown that these particles constitute about 20% of the intensity of mesotrons and that they are not connected genetically with the electrons, quanta, or mesotrons and that they are produced by an independent component. . ."

523.165 + 537.591 **74**

Equilibrium Spectrum of the Soft Component of High Energy Cosmic Rays.—A. Migdal. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 2, pp. 87–92.) Numerical calculations for energies several times greater than critical energy.

523.165 : 523.7 : 525.2 **75**

On Currents of Fast Charged Particles induced by Revolving Magnetized Cosmic Bodies.—J. P. Terlezky. (*C.R. Acad. Sci. U.R.S.S.*, 20th April 1945, Vol. 47, No. 2, pp. 101–102.) An electric field is induced around the earth and sun owing to the non-coincidence of their magnetic axes and axes of rotation. This field will accelerate charged particles. The maximum energy attainable in the earth's field due to this cause is 3.10^4eV, and in the sun's field, 2.10^8eV. Similar phenomena associated with other stars may induce currents of particles with energies of the order of that of cosmic ray particles.

523.7 : 621.396.822 **76**

Radio Waves from the Sun.—G. C. Southworth. (*Nature, Lond.*, 1st Sept. 1945, Vol. 156, No. 3957, pp. 273–274.) Review of 3252 of 1945 in relation to the work of Jansky (948 of 1938 and earlier work) and Reber (336 of 1943 and earlier work, and 1028 of 1945).

523.755 : 551.51.053.5 **77**

Problems of the Solar Corona.—M. Waldmeier. (*Naturwissenschaften*, Feb./Mar. 1944, Vol. 32, Nos. 5/13, pp. 51–57.) Includes an account of the origin in the corona of the intense ultra-violet radiation that probably causes the ionosphere.

523.78 : 621.396.11 **78**

" Mass Attack " on Secrets of Radio Waves.—(*See* 165.)

537.591 **79**

What are Cosmic Rays? [Book Review].—P. Auger. Univ. of Chicago Press, 1945, 128 pp., $2.00. (*Sci. Mon., N.Y.*, Aug. 1945, Vol. 61, No. 2, p. 158.) " . . . very short and very well written," but necessarily incomplete.

LOCATION AND AIDS TO NAVIGATION

621.396.11 : 538.566.2 **80**

Experimental Investigation of the Structure of an Electromagnetic Field over the Inhomogeneous Earth's Surface.—Alpert & Gorozhankin. (*See* 161.)

621.396.6 : 629.13, **81**

The Marconi General Purpose Aircraft Wireless Equipment.—Scott. (*See* 238.)

621.396.677 **82**

The Design of Directional Aerial Arrays.—Cooper & Green. (*See* 36.)

621.396.9 **83**

Radar Warfare.—D.G.F. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 92–97.) A general descriptive article illustrated by twelve photographs. It includes the CH early warning stations and plotting centres, GCI and AI (ground control of interception and airborne interception), PPI (plan position indicator) with examples of " shadow pictures", and some account of the radar gun-control systems.

621.396.9 **84**

Radar in the United States Army.—R. B. Colton. (*Proc. Inst. Radio Engrs., N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 740–752.) " The evolution of radar technique is traced and the radar-development program of the United States Army Signal Corps at the Signal Corps Laboratories, Fort Monmouth, New Jersey, described from its inception to America's entry in the War. Two radars developed by the Signal Corps Laboratories during this period, SCR–268 and SCR–270, are described in detail."

Original tests on SCR–268 showed the range to be 40 000 yd with an average distance error of 700 yd, an azimuthal error of 4°, and an elevational error of 2½°. The final design operated at a frequency of 205 Mc/s with a pulse rate of 4 100 per sec. The duration of the pulse was 5 μs, and the peak power 50 kW.

SCR–270, designed for long-range warning, had a power of 100 kW at a carrier frequency of 110 Mc/s. The pulse rate was 625 per sec and the duration 15 to 40 μs. The array rotated 5 revs per min. The range was 120 miles for bombers and 75 miles for fighters. The distance error was 2 miles and the direction error 4°. A plan-position indicator was introduced. See also 87.

621.396.9 **85**

Fundamentals of Radar—2. —(*Wireless World*, Nov. 1945, Vol. 51, No. 11, pp. 326–329.) The Air Interception (AI) system working on 1½ metres and at centimetre wavelengths is described, the former using fixed aerials with broad polar diagrams, the latter using a narrow beam, scanning spirally. The theoretical relations between transmitted power, range and wavelength are discussed. For part 1 see 3903 of 1945.

621.396.9 **86**

Radar in War and in Peace.—R. Watson-Watt. (*Nature, Lond.*, 15th Sept. 1945, Vol. 156, No. 3959, pp. 319–324.) An historical review of the war-time and pre-war development of radar, and a discussion of peace-time applications.

621.396.9 **87**

The SCR-268 Radar.—D. G. F. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 100–109.) The transmitting and receiving arrays are mounted on a pedestal and are manually controlled. The transmitting array consists of 16 crossed-dipoles and 16 reflectors with an open transmission line; the azimuth receiving array consists of a "bill board" 6 dipoles wide and 4 dipoles high with reflectors; the elevation array consists of a similar "bill board" 2 dipoles wide and 6 dipoles high. The transmitting beam is 10° wide between the 3 db points; the azimuth and elevation arrays have a directivity of 12° and 9° respectively, and lobe switching is provided, giving an accuracy of ± 1°. The range accuracy is ±200 yards. The keying unit includes a 4 098 c/s electron-coupled Hartley oscillator using a 6SJ7 valve. By means of sharpening, flattening, and over-driven amplifier circuits, short pulses are produced which are successively amplified by a 6F6 stage, two 6L6 valves in parallel, and a 304 TL triode. A peak pulse of 3 500 volts is thereby applied to the modulator unit, which includes eight 304 TL valves in parallel. The transmitter includes sixteen 100TS valves in a ring circuit. The essential features are pulse repetition frequency 4 098 per sec, pulse width 6 μs, peak power 75 kW, radio frequency 205 Mc/s, receiver power sensitivity 10^{-13} W, maximum range 22 miles, total weight 37 tons, total power required 15 kVA. A-scope presentation is utilised with "split image" display. See also 84.

621.396.9 **88**

Radar and the Bell System.—(*Bell Lab. Rec.*, Sept. 1945, Vol. 23, No. 9, pp. 325–328.) A short account of radar applications in various theatres of war with special reference to the part played by the Bell System Laboratories.

621.396.9 : 623.454.25 **89**

Proximity Fuse.—(*Wireless World*, Nov. 1945, Vol. 51, No. 11, p. 331.) A complete transmitter and receiver with aerial, batteries and fuse-operating mechanism, is built into the nose of an anti-aircraft shell. The transmitter sends out a cone of c.w. radiation which is reflected by the target and arrives back at the receiver at a different frequency due to relative motion of the shell and target (Doppler effect). The beat note formed is amplified and used to trigger the fuse.

MATERIALS AND SUBSIDIARY TECHNIQUES

538.221 : 621.317.41.029.5 **90**

Permeability of Iron at Radio Frequencies.—A. W. Smith, F. P. Dickey & S. W. Foor. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 268..280.) Summary of 1603 of 1945.

594.514.1 : 537.228.1 : 621.39 **91**

Piezo Electric Quartz Crystals.—J. L. Creighton. (*P.O. elect. Engrs' J.*, Oct. 1945, Vol. 38, Part 3, pp. 65–69.) The relationship between the atomic grouping and the piezo-electric effect. Methods of applying piezo-electric crystals to telecommunications. Methods of minimizing the variation with temperature of crystal oscillators.

594.514.1 : 537.531 : 621.396.611.21 **92**

X-rays Alter Wavelength, Change Color of Gems.—(*See* 126.)

620.193.7 **93**

Cathodic Protection.—L. H. Woodman. (*Sci. Amer.*, July 1945, Vol. 173, No. 1, pp. 44–46.) Corrosion of underground metallic structures by the action of galvanic currents may be prevented by connecting to them large masses of magnesium. These have a higher potential than the structure, which becomes a cathode and is not corroded.

620.193.7(213) : 621.315.5 : 621.315.6 **94**

Electrolytic Corrosion—Methods of Evaluating Insulating Materials used in Tropical Service.—Thompson & Mathes. (*See* 256.)

621-752 : 621.38/.39 **95**

Vibration Control for Electronic Products.—F.H. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 134–139.) A review of the many types of specialised units designed to provide isolation from vibration and shock. Many types of rubber mountings are described and illustrated, and the degree of vibration absorption in each case is stated.

621-752 : 678 **96**

Vibration Insulation and Structural Rubber.—J. A. Connon. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, June 1945, Vol. 64, No. 6, pp. 324–328.) A compilation of information on the fundamentals of mechanical vibrations and the properties of structural rubber, related especially to the protection of delicate equipments.

621.3.032.53 **97**

Glass-to-Metal Seal Design.—W. J. Scott. (*Electronic Engng*, Nov. 1945, Vol. 17, No. 213, pp. 764–767.) Factors which need consideration are wetting, stress, expansion, elasticity, plasticity, and shaping to avoid local stress concentrations. Excerpt from a comprehensive paper to appear in *J. sci. Instrum.*

621.315.616 : 546.287 **98**

The Application of Silicone Resins to Insulation for Electric Machinery.—J. DeKiep, L. R. Hill & G. L. Moses. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, Mar. 1945, Vol. 64, No. 3, pp. 94–98.)

Tests on silicone resins, silicone treated materials, and wire-wound apparatus treated with silicone varnish show a considerable improvement in the thermal endurance of the insulation. While further tests are required, it is suggested that this class of insulation should be differentiated from class B and C insulation, with appropriate temperature limits, so that designers may make use of its advantages. For discussion see *Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, June Supplement 1945, Vol. 64, pp. 460–462.

621.315.616 : 546.287 **99**
Organo-Silicon Compounds for Insulating Electric Machines.—T. A. Kauppi & G. L. Moses. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, Mar. 1945, Vol. 64, No. 3, pp. 90–93.) The physical and chemical properties of the silicone compounds are described. The use of these resins in place of the organic resins used as bonds, impregnants and surface treatments, gives a great improvement in the thermal stability of the insulation, the most important single factor in insulation life. For discussion see *Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, June Supplement 1945, Vol. 64, pp. 457–458.

621.315.616 : 679.5 **100**
Notes on Plastics.—J. Taylor. (*Electrician*, 16th Nov. 1945, Vol. 135, No. 3520, pp. 541–542.) The dielectric constant and power factor at high frequencies of polystyrene are both low. Its mechanical properties do not change much with temperature up to 70° C; a chlorinated compound, polydichlorstyrene, is stable up to 112° C. Polystyrene is light, water-resistant, and unaffected by weak acids, strong alkalis and many organic solvents. It has a high refractive index and good light transmission properties so is used for special lenses in light condensers and signal lamps. Styrene can be made to co-polymerise with other polymers, such as butadiene, to produce synthetic rubbers for use as wire and cable coverings.

621.315.617.3 **101**
Control of Electrical-Insulating Varnishes.—D. L. Gibson & C. H. Braithwaite. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, July 1945, Vol. 64, No. 7, pp. 520–524.) Varnishes used in the manufacture of radio equipment do not have reproducible properties unless frequent checks are made of chemical and physical properties. A suitable routine involves daily measurements of viscosity and density, and periodic chemical examination, with adequate filtration of the varnish.

621.317.35 **102**
Graphical Analysis of Complex Waves.—L. S. Cole. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 142–145.) A simple account of the Fourier analysis of a complex wave-form, giving the detail and formulae for 6-, 8-, and 12-point schedules.

621.318.22 **103**
Industry's Permanent Pull.—(*Sci. Amer.*, July 1945, Vol. 173, No. 1, pp. 36 . . 49.) Properties and uses of some modern materials used for permanent magnets.

621.385.832 **104**
Characteristics of Luminescent Materials for Cathode Ray Tubes.—(*J. Televis. Soc.*, June 1945, Vol. 4, No. 6, pp. 143–144.) Summary of a discussion by the Radio Section I.E.E., led by C. G. A. Hill.

621.386.1 : 620.179] (091) **105**
The Growth of Industrial Radiology.—L. Mullins. (*Electronic Engng*, Nov. 1945, Vol. 17, No. 213, pp. 760–763.) Within a year of the discovery of X-rays their use for industrial purposes had commenced. Advances in photographic film, and in the design of tubes have helped the subsequent growth of radiology, which was greatly accelerated during the two world wars.

MATHEMATICS

51 **106**
An Extension of the Limits of Applicability of the Small Parameter Method [for solving non-linear oscillation problems].—S. M. Rytov. (*C.R. Acad. Sci. U.R.S.S.*, 30th April 1945, Vol. 47, No. 3, pp. 181–184.)

517.512.2 : 621.317.35 **107**
Note on the Fourier Series for Several Pulse Forms.—Lattin. (*See* 116.)

531.2 **108**
The Stress Distribution in a Long Circular Cylinder when a Discontinuous Pressure is applied to the Curved Surface.—C. J. Tranter & J. W. Craggs. (*Phil. Mag.*, April 1945, Vol. 36, No. 255, pp. 241–250.)

534.131 **109**
The Oscillations of an Isotropic Elastic Sphere.—G. I. Petrashen. (*C.R. Acad. Sci. U.R.S.S.*, 30th April 1945, Vol. 47, No. 3, pp. 172–176.)

621.392.5/.6 **110**
The Application of the Characteristic Equation of a Matrix to the Evaluation of the Range of Frequencies for which Currents are passed through Networks with Four or More Terminals without Attenuation.—H. V. Lowry. (*Phil. Mag.*, April 1945, Vol. 36, No. 255, pp. 255–264.)

621.396.615.17 **111**
Theory of Synchronization of Relaxation Auto-Oscillatory Systems.—K. Theodorchik. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 2, pp. 139–143.) The general theory is worked out by König's iteration method and conditions of stable synchronisation are found by plotting some of the functions as in Lamerey's method. It is shown that the Nth order synchronisation bands can never overlap.

51 : 621.39 **112**
Applied Mathematics for Radio and Communication Engineers [Book Review].—C. E. Smith. McGraw-Hill, N.Y., 231 pp., $3.50. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 422..426.) A " refresher course for home study . . ."

518.2 **113**
Sechsstellige Trigonometrische Tafel [Book Review].—H. Brandenburg. Lorentz, Leipzig, reproduced by Edwards, Michigan, 304 pp., $5.00. (*Phil. Mag.*, Apr. 1945, Vol. 36, No. 255, p. 296.) With a list of errata by L. J. Comrie.

MEASUREMENTS AND TEST GEAR

621.317.33 : 621.315.212.1 **114**

Coaxial Cable Tests.—P. H. Ware. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 130–134.) An elementary description of the measurement of cable characteristics at relatively low radio frequencies by the open and shorted method, using series or parallel substitution in closed resonant circuits and observing the change of reading of a variable air capacitor and the change in the width of the resonance curve; or by similar substitution in a radio-frequency bridge. The relevant formulae and some typical examples are included.

621.317.35 **115**

Graphical Analysis of Complex Waves.—Cole. (*See* 102.)

621.317.35 : 517.512.2. **116**

Note on the Fourier Series for Several Pulse Forms.—W. J. Lattin. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 783–784.) "Fourier-series expressions for symmetrical rectangular, triangular, and trapezoidal pulses are derived in a form from which general curves of the magnitudes of the harmonic-amplitude coefficients may be plotted. From these curves it is possible to obtain the values of the amplitude coefficients of the harmonics for any ratio of pulse duration t to cycle period T."

621.317.353 **117**

A Simple Method of Measuring Distortion in A.F. Oscillators and Amplifiers.—L. W. Smith. (*R.S.G.B. Bull.*, Nov. 1945, Vol. 21, No. 5, pp. 71–72.) The output of the amplifier is connected through a potentiometer to a bridge circuit which can be adjusted to balance out the fundamental frequency, using a high-gain amplifier with a visual indicator in the output as a detector. With the fundamental present, the same reading in the detector is obtained by adjusting the potentiometer; the two potentiometer readings give the ratio of the harmonics to the full wave.

621.317.382 **118**

Power Measurements at Very High Frequencies.—W. Maron. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 216–217.) Measurement in the range 20–40 W at 100 Mc/s by means of a 60 W 110 V. lamp (resistance about 70 ohms), the brightness of which is measured by a photocell. The lamp is calibrated by low-frequency a.c..

621.317.41.029.5 : 538.221 **119**

Permeability of Iron at Radio Frequencies.—A. W. Smith, F. P. Dickey & S. W. Foor. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 268..280.)—Summary of 1603 of 1945.

621.317.7 **120**

Industrial Test Equipment Design.—T. Powell. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 135–137). A paper based on notes made during the training and supervision of a crew of repair-force men in a large ship-yard, where test gear was roughly handled. It details vulnerable features and emphasises the need for better dust and water proofing.

621.317.726 : 621.3.015.33 **121**

Transient Peak Voltmeter.—C. Ryerson & M. Aronson. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 110–111.) The amplitude of a single short pulse is determined by amplifying the transient voltage, then charging a capacitor through a diode, the holding-on action of which permits the charge to be maintained long enough for measurement by means of a balanced-bridge d.c. voltmeter equipped with a 0–200μA indicating instrument. The device has four ranges, 1, 5, 10 and 20 V full scale, and is a.c.-mains operated.

621.317.73 **122**

Reactor Measurements.—H. L. Daniels. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 146–148.) Describes a complete source and valve-voltmeter network for the measurement of the characteristics of air- or iron-cored inductors so that these characteristics are not affected by the rest of the circuit. The valve source, from which a.c. and d.c. can be derived simultaneously is arranged, by the use of current feed-back, to have an exceedingly high output impedance (2.5–90 megohms, depending on the selected current range, 0.3–50 mA) and the valve voltmeter is buffered by a cathode-follower circuit. Details of the method of measurement are given.

621.317.73.083.4.085.3 **123**

Bridge Null-Indicator.—E. W. Herold. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 128–129.) A sensitive tuned null indicator for a 1 000 c/s bridge, providing discrimination against harmonics, off-balance phase indication, visual balance indication, and over-load protection derived from delayed automatic gain-control. An input of 10 μV is sufficient to give an observable deflection on either the meter or the cathode-ray indicators.

621.317.738 : 621.385.032.2 **124**

Production Tester for Small Values of Capacitance.—L. Y. Hanopol. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 160..180.) The instrument consists of a constant-voltage source, a measuring network, and a high-impedance detector. A frequency of 465 kc/s is used, and the detector consists of a high-gain, three-stage, band-pass amplifier. An accuracy of 3 per cent. is claimed over the range 0.005 to 200 $\mu\mu$F. A two-page article.

621.319.4 : 621.317.372 **125**

Determining Q of Capacitors.—Pepperberg. (*See* 49.)

621.396.611.21 : 537.531 : 594.514.1 **126**

X-rays Alter Wavelength, Change Color of Gems.—(*Elect. Engng., N.Y.*, July 1945, Vol. 64, No. 7, p. 250.) A short note mentioning, *inter alia*, the use of X-ray irradiation for rapidly adjusting the frequency of a quartz crystal to a desired value.

621.396.615.12 **127**

Design of Stable Heterodyne Oscillators.—Moore. (*See* 241.)

621.396.615.17 : 621.317.755] .089.6 **128**

Time-Base Calibration.—W. W. Ludman. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 117–119.) Time-displacement linearity of oscilloscope sweep is measured at tenth-microsecond intervals by the use of a crystal-controlled multivibrator chain. The circuit described provides a sweep-triggering pulse and a constant-amplitude continuous calibrating signal.

621.396.619 : 621.396.615.17 **129**

Square-Wave [pulse] **Modulator for Signal Generator.**—W. R. Piggott. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 260..268.) Summary of 1536 of 1945.

621.396.67 : 621.317.384.029.56/.58 **130**

A Proposed Standard Dummy Antenna for Testing Aircraft-Radio Transmitters.—Stewart. (*See* 243.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

351.811 : 621.38 **131**

Automatic Control of Vehicular Traffic.—(*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 150..154.) Brief description of an automatic vehicle controller developed by the Northern Electric Co., Montreal. The detector, which is buried in the ground at each approach to an intersection, comprises two magnetised parallel steel bars with coil assemblies mounted so that passage of a vehicle induces a small voltage. The voltage is amplified and operates relays which control the dispatching system of lights.

535.336.2.05 : 621.389 **132**

Electronics of the Mass Spectrometer.—J. A. Hipple, D. J. Grove & W. M. Hickam. (*Elect. Engng, N.Y.*, April 1945, Vol. 64, No. 4, pp. 141–145.) Deals with the technique of making an automatic self-recording mass-spectrograph. A motor-driven potentiometer varies the magnetic field, and the ion current is measured by a Speedomax recorder energised through a d.c. amplifier. Automatic provision is made for increasing scanning speed when the ion current drops below a predetermined level. Two automatic devices are incorporated which enable recording to be carried out over a wide range of ion currents. A " mass-marker " calibration circuit is provided.

61 : 621.396.6 **133**

Medical Probe.—R. E. Ricketts. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 300..312.) A preliminary description of a portable u.s.w. transreceiver which can be used to indicate irregularities of bone and organs under the skin, and the size and placement of large organs, by utilising the effect of differences in the permittivities of tissue.

620.179.14 : 621.38 **134**

Crack Detector for Production Testing.—J. H. Jupe. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 114–115.) Description of a compact electronic instrument designed by Salford Electrical Instruments Ltd. The specimen is in the magnetic field of an oscillator. The induced eddy currents affect the frequency to an extent dependent on the presence of surface cracks. The instrument can indicate cracks from 0.000 5 to 0.25 inch deep.

621 : 621.395.625 **135**

It Pays to Listen [Detection of faults in machinery by change in characteristic noise]. (*See* 18.)

621.3.083.7 **136**

A Modulated-Frequency System of Telemetering.—H. E. Renfro & A. P. Peterson. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, Feb. 1945, Vol. 64, No. 2, pp. 45–47.) Two variable capacitors, having a common rotor fixed to the spindle of the primary instrument, are incorporated in the transmitter, and so arranged that the capacitance of one increases as the capacitance of the other decreases. The plates are shaped so that the edge exposure, and therefore the electrostatic torque on the rotor due to edge effect, is dependent only on the potential difference between the rotor and the stators, and is independent of the angular position of the rotor. With the same potential difference applied across each capacitor the torque is neutralised and the calibration of the primary instrument is therefore not invalidated by electrostatic torque on the rotor. The capacitors vary the frequency of two temperature-compensated oscillator circuits, between 50–49.5 kc/s, and 60–60.5 kc/s, respectively. The difference frequency is fed through a low-pass filter to an amplifier that is transformer coupled to the line to the receiver at the control station. The receiver consists of a high-frequency amplifier, a local oscillator of fixed frequency 9.9 kc/s, that gives a difference frequency of 100–1 100 c/s with the incoming signal. This is passed through a low-pass filter to an amplifier feeding a frequency meter incorporating the final indicating instrument. Six complete sets of this system have been in continuous operation for several years.

621.3.083.7 : 654.942 **137**

Electronics Aids Waterway Development.—E. H. Woodman. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 120–128.) A description of devices used by the U.S. War Dept. Engineering Corps. For the measurement of wave heights in breakwater and harbour studies, a vertical set of contacts is arranged so that the water short-circuits some of them. The contacts are connected to a resistance potentiometer and the current produced when constant potential difference is applied depends on the number immersed. For hydrostatic pressure measurement a cell has been developed with a diaphragm which, on flexing, changes the reactance of an iron-cored inductance, and for strain measurement, resistance-wire strain gauges are used. Associated electronic equipment is described. Some of the devices have been used for recording the deflection of road and pavement surfaces.

621.314.3 : 578.088.7 **138**

Biological Amplifiers.—Parnum. (*See* 45.)

621.314.3 : 578.088.7 : 621.396.822 **139**

Biological Amplifiers.—Parnum. (*See* 44.)

621.315.1/.5 : 621.317.3.082.78 **140**

Wire Splice Detector.—F. S. Hird. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 98–99.) Steel wire under test is magnetised longitudinally by passing it through a strong magnetic field. It is subsequently passed through a detector coil in which voltages are generated by the motion of the magnetic poles produced at the discontinuities. The sensitivity is such that a single-strand splice in a 14-strand cable can be detected.

621.316.313 **141**

Dual A-C Network Calculator.—Parker. (*See* 47.)

621.317.787.2 : 621.316.5.064.2 **142**

An Interval Timer for [switching-] **Arc Duration.**—J. S. Quill. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, May 1945, Vol. 64, No. 5, pp. 237–240.) Voltage appearing across the opening contacts under test starts the timing, and current disappearing from the circuit finishes it. During the interval a capacitor charges linearly, the final voltage across it gives a measure of the arc time.

621.318.572 **143**

Electronic Counting.—Weber. (*See* 50.)

621.362 : 621.3.036.64 **144**

Electronic Control of Furnace Temperatures.—(*Elect. Engng, N.Y.*, Aug. 1945, Vol. 64, No. 8, p. 289.) See 4124 of 1945.

621.365.5 + 621.365.9 + 621.369 **145**

The Place of Radiant, Dielectric and Eddy-Current Heating in the Process Heating Field.—L. J. C. Connell, O. W. Humphreys and J. L. Rycroft. (*J. Instn elect. Engrs*, Part II, Oct. 1945, Vol. 92, No. 29, pp. 385–399. Discussion, pp. 399–402.) The paper outlines the various methods of heating available and points out the particular features of each. General formulae are given for heating and temperature distribution where possible. Tables indicate methods technically suitable and preferable for heating insulators or conductors under various conditions of rate of rise of temperature and heat penetration. Methods involving heat transfer from an external source include contact heating, natural and forced convective heating, and radiant heating using lamps or exposed resistors.

Several industrial applications are treated in detail. These include the setting of adhesives, drying of surface finishes, treatment of plastics, drying, and surface hardening of metals. Long bibliography.

621.365.5 + 621.365.92 **146**

High-Frequency Heating of Conductors and Non-Conductors.—R. M. Baker & C. J. Madsen. (*Elect. Engng, N.Y.*, Feb. 1945, Vol. 64, No. 2, pp. 50–57.) The simple theory of induction and dielectric heating is given, with its applications to various industrial processes, such as brazing, soldering, curing, case-hardening and heat-treating. Induction heating is inherently non-uniform, dielectric heating, provided the material is homogeneous, gives almost perfect uniformity in heating throughout. High-frequency heating is usually more expensive than more conventional methods, both in cost of equipment and in running costs, but it is more adaptable; it increases the speed of the process, advantageous when rapid heating is required, as in surface hardening and in continuous processes, and it is clean and compact. It can be used on materials such as iron, steel, brass, copper, wood, plastics, paper, nylon and other synthetics, rubber, and food. Electronic sources of high-frequency heat are more costly than rotating machine generators, but electronic sources permit the use of higher frequencies, an advantage in many applications, although, for a given size of material, there is an upper limit to the frequency because stationary wave patterns may be formed with consequent non-uniformity of heating.

621.365.52 **147**

Induction Heating of Moving Magnetic Strip.—R. M. Baker. (*Trans. [mon.] Amer. Inst. elect. Engrs*, April 1945, Vol. 64, No. 4, pp. 184–189.) Derivation of equations for power-factor efficiency and density of heating under all conditions. General curves illustrate the limitations of strip thickness, frequency, and density of heating. Factors controlling the choice of frequency are discussed: " At strip speeds of 1 000 feet per minute and a temperature rise of 250°C, strips thicker than 0.04 cm can be heated satisfactorily at 9 600 c/s."

621.365.52 **148**

Design of Induction-Heating Coils for Cylindrical Nonmagnetic Loads.—J. T. Vaughan & J. W. Williamson. (*Trans. [mon.] Amer. Inst. elect. Engrs*, Aug. 1945, Vol. 64, No. 8, pp. 587–592.) " Equations are presented for the calculation of the required number of coil turns to match a given power source for [single layer] solenoidal coils with coaxial cylindrical loads of non-magnetic materials in electromagnetic induction circuits. The equations apply to both solid and hollow loads. A correction factor is established for coil shortness providing the coil length is equal to or greater than the coil diameter. Also given are equations for power distribution and impedance values. The accuracy of the calculations is substantiated by experimental results."

621.365.92 **149**

A Survey of Dielectric Heating.—M. J. Maiers. (*Elect. Engng*, June 1945, Vol. 64, No. 6, pp. 210–211.)—Developments in the use of alternating electric fields (3–30 Mc/s) for heating non-conducting materials. The destruction of weevils in grain, the manufacture of plywood and other fabricated wooden articles, the dehydration of hygroscopic materials, and the cooking of food. The greatest advantage over other methods of heating is the development of heat throughout the body of the substance instead of at its surface only.

621.365.92 **150**

The Role of Frequency in Industrial Dielectric Heating.—G. W. Scott, Jr. (*Trans. [mon.] Amer. Inst. elect. Engrs*, Aug. 1945, Vol. 64, No. 8, pp. 558–562.) None of the variables in the heating equation is completely independent of frequency. As the frequency is increased the overall heating efficiency is reduced by the effect of stray capacitance the useful load capacitance decreases and the useful length of material which can be dealt with is reduced because of troubles due to standing waves. Increasing the frequency may reduce the duration of the heating cycle, but increased production rate may not be economical unless accompanied by increased volume of production. For large-scale industrial heating involving load capacitances up to 500$\mu\mu$F, and output powers as high as 100 kW, the frequency band 10–30 Mc/s will prove most useful.

621.365.92 : 679.5 **151**

Better Plastics Heating.—(*Sci. Amer.*, July 1945, Vol. 173, No. 1, pp. 22–24.) An account of high-frequency heating.

621.38 **152**

Electronics—An Industry Comes of Age.—D. D. Knowles. (*Elect. Engng, N.Y.*, Mar. 1945, Vol. 64, No. 3, pp. 106–108.) Radio, and the use in all aircraft and on all ships of detection devices developed during the war, will probably remain for some time the greatest field for the application of electronics, but others are being developed rapidly. Induction and dielectric heating increase the speed and efficiency of many processes. The use of power transmission lines to carry information saves money and material. Electrical power can be converted into any form, and switched quickly and accurately. Other applications are in specialised instruments such as the electron microscope and the mass spectrometer.

621.38 : 6 **153**
Electronic Applications in [U.S.] **Industry.**—Sommer. (*See* 213).

621.396.9 : 623.454.25 **154**
Proximity Fuse.—(*See* 89.)

629.13 : 621.38 **155**
Aviation's Electronic Requirements.—D. W. Rentzel. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. f288..300.) The requirements, for which performance desiderata are detailed, include an obstacle indicator, radio altimeter, automatic position reporter, and a means of sending written communications to aircraft.

629.13 : 621.38 **156**
Fingertip Control for Formation Flying.—D. G. Taylor & G. Volkenant. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 98–101.) Description of a pistol-grip control, which, by means of two mutually perpendicular potential dividers, introduces signals into the auto-pilot bridge circuits, thus enabling the advantages of the auto-pilot controls to be combined with effortless manual control in formation flying.

629.13 : 621.38 **157**
Flying Electronics.—V. Zeluff. (*Sci. Amer.*, June 1945, Vol. 172, No. 6, pp. 348–350.) Many electronic devices are now available for improving the safety and consistency of aviation. In commercial and private aviation these will be used for navigation, communication, accurate indication of fuel supply, warning of ice formation, landing, and collision warning.

629.13 : 621.38 **158**
Control in the Air.—(*Sci. Amer.*, July 1945, Vol. 173, No. 1, pp. 26–28.) Methods of operating flying controls, and of controlling the engine and other features of an aircraft by the use of electronic devices.

669 : 621.38 **159**
Metals by Electronics.—V. Zeluff. (*Sci. Amer.*, April 1945, Vol. 172, No. 4, pp. 210–212.) Many processes in the production of metals have been speeded up and improved by the use of electronic devices. Photoelectric cells have been used to control tipping at the mines, to regulate shearing and other processes in the mills and to detect holes in sheet metal. Photoelectric pyrometers control high temperature processes, and mercury arc rectifiers supply d.c. power to large industrial plants.

PROPAGATION OF WAVES

538.566 : 621.396.11 **160**
Diffraction of Radio Waves by Surface of Earth.—V. A. Fock. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 2, p. 150.) Summary of a paper before the Acad. Sci., U.S.S.R. A theoretical investigation assuming a homogeneous earth surface, taking account of diffraction, but neglecting ionosphere. An approximation to the exact value of the vertical field component is obtained as a function of the height of the source, the distance of the receiver, the radius and dielectric property of the earth. Well-known formulae can be obtained by reduction of the expression given. Methods are given for the numerical evaluation of the series and integrals used.

538.566.2 : 621.396.11 **161**
Experimental Investigation of the Structure of an Electromagnetic Field over the Inhomogeneous Earth's Surface.—J. Alpert & B. Gorozhankin. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 2, pp. 115–122.) The phase structure of the field over a stretch of sea near a hilly coast is investigated by a radio interferometer and a direction finder. The results are plotted as contours of equal phase velocity and show variations of as much as 0.5% in some directions at distances up to 5λ from the radiator. At distances of the order of 8λ, for all directions, the phase velocity approximates to c. The direction-finding errors are of different sign according to the angle of the shore line, whereas most workers have indicated that the sign of the coastal error must always be negative.

621.316.99 **162**
Grounding Principles and Practice, I.—Fundamental Considerations on Ground Currents.—Rüdenberg. (*See* 29.)

621.392 **163**
The Plane-Wave Resolution of Guided Waves.—Mackeown & Miles. (*See* 30.)

621.396.029.63/.64 **164**
Microwave Techniques.—Jenks. (*See* 185.)

621.396.11 : 523.78 **165**
"Mass Attack" on Secrets of Radio Waves.—(*Proc. Instn Radio Engrs, Aust.*, Aug. 1945, Vol. 6, No. 2, pp. 9–10.) The effects of the recent solar eclipse on the ionisation of the atmosphere were studied by observing the variation of received signal strength of long, medium and short wave transmissions over paths that passed through, or close to, the track of totality, by vertical incidence measurements of the heights of the ionised layers, by direction-finding measurements, and by radar.

RECEPTION

621.314.3 + 621.383 + 621.396.62 **166**
The State of Development and Physical Limit [of sensitivity] **of Communication Devices, Radiation Converters and Radiation Storage Devices.**—O. Schäfer. (*Naturwissenschaften*, Feb./Mar. 1944, Vol. 32, Nos. 5/13, pp. 62–68.) A comparison of the physical and practical limits of sensitivity of a number of devices for converting energy from one form to another.

The limiting sensitivity of the dark-adapted retina can be such as to enable detection of about one quantum per second per light-sensitive element. This corresponds to perception of a point light source giving a power flux at the pupil of about 10^{-16} W/cm^2, though some writers give a smaller figure. The ear can detect a continuous note at 2 000 c/s with a power flux of 10^{-16} W/cm^2. This limit is about 10 db worse than the physical limit due to thermal agitation of the air molecules against the eardrum.

The sensitivity of the condenser microphone is theoretically such as to enable the detection of impact of individual air molecules, but the practical limit of the sensitivity of microphones is set by the noise in the amplifiers with which they are associated. To overcome resistance noise alone in an amplifier, a microphone needs to deliver $4kT\Delta f$, corresponding to 10^{-16} W with $\Delta f = 10^4$ c/s, a sensitivity about the same as that of the unaided ear. Reduction of Δf to 1 c/s changes this figure to 10^{-20} W, but then the sound must last for at least one second because of the build-up time of the sharply-tuned resonator, and the mean frequency must not vary by more than $\frac{1}{2}$ c/s. This is an example of the increase of sensitivity by the use of an energy-storage device. Shot effect and other sources of receiver noise reduce the sensitivity further.

The limit of sensitivity of radio receivers depends on the noise in the amplifiers, and on cosmic and atmospheric noise. The aerial, considered alone, reaches its natural limit, as cosmic and atmospheric noise are easily detectable. In the wavelength ranges where these noises are small, telegraph signals containing about 10^{-19} Joule can be detected. At λ 10m this corresponds to a field with power flux about 10^{-23}W/cm^2, which is far smaller than the flux detectable by any other instrument or unaided sense organ. This performance is due to the aerial's property of collecting energy from an area of the wave-front equal to about $0.03\lambda^2$.

A modern alkali vacuum photocell yields about one electron per 100 incident light quanta, so that 10^3 quanta/sec is detectable assuming an adjustment time of 10 sec. With a cell requiring an exposure of 1 sec, the detectable energy flux is about 10^{-14} W/cm^2, *i.e.*, 100 times more than is needed for the eye. In low-pressure gas-filled cells in which multiplication of the current is produced by ionisation, the sensitivity is increased to about equal to that of the eye (10^{-16} W/cm^2). The light-counter can detect about 10 quanta/sec with an adjustment time of 10^{-2} sec. In storage cameras such as the iconoscope increased exposure would greatly increase sensitivity, but a limit is set by amplifier noise and by imperfection of the device itself. A television equipment is about 10^3 less sensitive than the eye. An image converter (*Bildwandler*), in which an image at an invisible wavelength (*e.g.*, infra-red) is converted to a visible image, requires 10^{11} quanta/sec per sensitive element.

A sensitised photographic emulsion has a physical limit of about one absorbed quantum per grain, but the spontaneous reduction on development of a number of the unexposed grains causes a practical limit worse by 10^2 or 10^3. For a panchromatic emulsion exposed for 1 sec through a lens corresponding to that of the eye, 10^3 times more light is needed to produce a detectable image than is needed to stimulate the eye.

621.396.029.63/.64 **167**

Microwave Techniques.—Jenks. (*See* 185.)

621.396.3 : 621.396.812.3 **168**

High-Speed Radio-Telegraphy.—Robinson : Roddam. (*See* 188.)

621.396.611.21 : 621.396.621.54 : 621.396.619.081.41 **169**

Crystal Tuned F.M. Receivers.—W. Maron. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 138–141.) The full realisation of f.m. possibilities requires a very high degree of local oscillator stability (±0.01%). The article states the case for quartz-crystal control of the local oscillator, using separate crystals for each station to be received. It gives a detailed description of an experimental receiver built to receive any of eight f.m. stations in the band 42–50 Mc/s. The crystals were of about 5 Mc/s fundamental frequency, and the fifth harmonic was used for control. Stations were selected by an 8-position switch.

621.396.611.21 : 621.396.621.54.029.6 **170**

Crystal Oscillators in F.M. and Television [receivers].—S. X. Shore. (*Communications*, Sept. 1945, Vol. 25, No. 9, pp. 54..88.) A description of some crystal plate cuts and their application in v.h.f. receivers is given and illustrated with circuit diagrams. In general, crystals are best suited to fixed-frequency working and so could be easily incorporated in press-button tuning systems. Variable-frequency crystals allowing of tuning over several hundred kc/s can be made, but are expensive and have a lower stability with temperature. Crystals can be cut so as to be easily excited to vibrate in harmonic modes. The AT cut is easier to excite than the BT cut, but with both, the frequency is limited to about 50 Mc/s by the shunt capacitance of the crystal. Continuation of 3826 of 1945.

621.396.615.12 **171**

Design of Stable Heterodyne Oscillators.—Moore. (*See* 241.)

621.396.619.018.41 : 621.396.82 **172**

Interference in F.M. Receivers.—R. N. Johnson. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 129–131.) Calculations on interference assuming an idealised frequency-modulation receiver are shown to be valid when applied to a representative commercial receiver. The type of interference considered is that which results from two signals having the same average frequency, one being considered as the desired signal, and the other as the interfering signal.

621.396.62 **173**

Radio Receiver Specifications including a Method of Specifying Performance.—A. S. McNicol. (*R.S.G.B. Bull.*, Nov. 1945, Vol. 21, No. 5, pp. 66–68.) Receiver specifications should be simplified so that the relative merit of any two receivers can be easily ascertained. A "Communications Index" could be used, based on a figure for each characteristic of the receiver, such as selectivity, sensitivity, noise equivalent, image ratio and tuning drift. Suggestions for determining these figures are given.

621.396.62 : 623.6 **174**

Army Set R107.—E. Forster. (*Wireless World*, Nov. 1945, Vol. 51, No. 11, pp. 343–344.) Comments on 3286 of 1945 by the designer of the set. On c.w. a signal of 1 μV will be heard 20 db above noise level at 3 kc/s bandwidth, and 0.4 μV for the same signal/noise ratio when the a.f. note filter is in use.

621.396.621.53 **175**

Long-Wave Converter.—H. B. Dent. (*Wireless World*, Nov. 1945, Vol. 51, No. 11, pp. 341–342.) A circuit diagram of a converter using a single triode-hexode valve, suitable for reception at 1 500 m when the receiver is tuned to 500 m.

621.396.822 **176**

Receiver Sensitivities and Noise at the Input Stage.—M. Morgan. (*Marconi Rev.*, Jan. 1945, Vol. 8, No. 76, pp. 24–31.) The noise has three components, due to the r.f. valve itself, the matching device between valve and aerial, and the aerial. It is most convenient to consider all noise sources in terms of their equivalent thermal-noise resistance because then for several sources simple addition of equivalent resistances enables the net noise to be determined. Simple equations are given for computing the value of each noise component, and typical examples for particular valves are given. Expressions are also derived for receiver sensitivity in terms of " detune " ratios.

621.396.822 : 523.7 **177**

Radio Waves from the Sun.—Southworth. (*See* 76.)

621.397.62 **178**

Separating Sound from Vision in Television Reception.—Sturley. (*See* 233.)

STATIONS AND COMMUNICATION SYSTEMS

621.314.65 : 621.396.71 **179**

High-Voltage Steel-Tank Mercury-Arc Rectifier Equipments for Radio Transmitters.—Read. (*See* 205).

621.314.65 : 621.396.71 **180**

The Application of High-Voltage Steel-Tank Mercury-Arc Rectifiers in Broadcast Transmitters—Bevan. (*See* 206).

621.39 **181**

Electrical Communication.—J. Mills. (*Sci. Mon., N.Y.*, Aug. 1945, Vol. 61, No. 2, pp. 138–142.) A general descriptive account of processes entailed in electrical communication systems, generation, modulation, amplification, transmission, selection, and demodulation, and some of the problems associated therewith.

621.39 : 623.6 **182**

[U.S.] **Army Ground Communication Equipment.**—R. B. Colton. (*Elect. Engng, N.Y.*, May 1945, Vol. 64, No. 5, pp. 173–179). Army equipment may be divided into fixed type and combat type. In base areas line telephony is primary, construction becoming lighter and more temporary as the combat area is approached. In the combat area radio communication is often the only possibility. Communication systems are organised in conformity with the military command, *e.g.* battalion communications. Various types of equipment are described.

621.391.1 **183**

Multichannel Communication Systems: Preliminary Investigation of Systems based upon Modulated Pulses.—F. F. Roberts & J. C. Simmonds. (*Wireless Engr*, Nov. 1945, Vol. 22, No. 266, pp. 538–549.) A discussion of the principles underlying communication systems involving pulse technique, using either a line or radio transmission link. Pulses of energy from each channel in turn are transmitted along the link, the pulse repetition frequency of each channel being at least twice that of the highest frequency contained in the signals. The pulse chains may be generated either mechanically or electronically, synchronisation being effected by a regular increase in amplitude, or reversal of polarity of one of the pulses. Several methods of modulation are available :—

(*a*) Amplitude—using double grid or triode valves.

(*b*) Pulse width—using a saturated triode: this has the advantage that non-linear distortion does not affect operation.

(*c*) Delay—this involves varying the time-relationship of the pulses in the given channel, using a phase-shifting circuit, or otherwise.

A mathematical analysis of each is given, together with a discussion of the required transmitter stability. Demodulation is accomplished by means of low-pass filters, charge and discharge of capacitors, or by using double-grid tubes. The usefulness of the radio link is restricted due to cross-talk between channels, but with a line link this can be reduced to tolerable proportions.

The first of two articles.

621.395.44 **184**

The Unit Bay 1B Coaxial Cable Transmission System.—R. A. Brockbank & C. F. Floyd. (*P.O. elect. Engrs' J.*, Oct. 1945, Vol. 38, Part 3, pp. 82–87.) Continuation of 3660 of 1945 describing the more important panels of the Unit Bay.

621.396.029.63/.64 **185**

Microwave Techniques.—F. A. Jenks. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 120–127.) A survey of propagation features and of terminal equipment design. Radiation and range formulae are given and illustrated, for non-directive and directive systems. It is shown, for example, that with parabolic reflectors, a tenth of a watt at 10 cm wavelength could give a range of over 4 000 miles. There is a brief description of the application of crystal control to transmitters and of automatic frequency control, by reference to a stabilised source or to a resonant cavity, for transmission and reception.

621.396.24 **186**

Microwave Communications Chain may replace Present Radio Beam System for Aircraft.—(*Telegr. Teleph. Age*, Oct. 1945, Vol. 63, No. 10, pp. 9..35.) Enthusiastic support for the proposed (U.S.) nation-wide Raytheon microwave relay system to work in seven broad bands between 1 900 and 2 600 Mc/s. Stations would be built on mountain tops to cover up to 500 miles, and facilities for television, f.m. *etc.*, provided. See also 3378 of 1945.

621.396.24 : 621.397.26 **187**

V.H.F. Multiple-Relay Television Network.—F. J. Bingley. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 102–108.) Description of a six-station chain through which video programmes originating in Washington are broadcast in the Philadelphia area, on frequencies in the 210–236 Mc/s band. Relay stations are on four hill-top sites giving 100ft clearance over all intervening terrain. The receiving and transmitting antennae are located near to each other but in positions of zero coupling, and operate on different carrier frequencies. In each relay station a synchronising expander unit is used to counteract the compression of the synchronising signal by the non-linear characteristic of the relay transmitters in the synchronising region.

621.396.3 : 621.396.812.3 **188**

High-Speed Radio-Telegraphy.—J. Robinson : T. Roddam. (*Wireless World*, Nov. 1945, Vol. 51, No. 11, p. 343.) Correspondence on the Romac system, following 3676 of 1945, on the intelligibility of the signals in conditions of fading.

621.396.44 : 621.315.052.63 **189**

Power-Line Carrier Channels.—M. J. Brown. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, May 1945, Vol. 64, No. 5, pp. 246–250.) The use of a power cable for carrier-frequency communication requires the consideration of factors not involved if the cable is designed for power alone. The characteristic impedance must be known for satisfactory design of the coupling to it of the communications equipment. The attenuation can be calculated from formulae giving the increase in resistance due to skin effect at the carrier frequency used, but measurement shows that losses may be up to five times the calculated value, particularly where stranded conductors are installed, so an empirical formula is given. Losses also occur in the couplings to the line, in the units necessary to by-pass apparatus (*e.g.* circuit-breakers) in the line, and in the traps isolating spur lines from the carrier-frequency current. With well designed equipment these losses should be small.

621.396.44 : 621.396.619 : 621.315.052.63 **190**

A Comparison of the Amplitude-Modulation, Frequency-Modulation, and Single-Side-Band Systems for Power-Line Carrier Transmission.—R. C. Cheek. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, May 1945, Vol. 64, No. 5, pp. 215–220.) The three systems are considered with reference to their ability to meet problems of attenuation, interfering noise, and required band-width. Frequency modulation only gives an improvement in signal/noise ratio at the expense of an increased band-width. With unity deviation the gain in signal/noise ratio obtained by using frequency modulation instead of amplitude modulation is 4.8 db with a 1.5 increase in band-width. The single-side-band system only requires half the band-width needed for amplitude modulation, and the gain in signal/noise ratio is 9 db when the same power is used. The communication system as a whole can be made more flexible when single-side-band is used. Amplitude-modulated systems can be readily converted to single-side-band by the addition of the necessary units. For discussion see *Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, June Supplement 1945, Vol. 64, pp. 450–452.

621.396.6 : 621.396.619.018.41 **191**

Airline V.H.F. F.M. Systems.—T. W. Hall. (*Communications*, Sept. 1945, Vol. 25, No. 9, pp. 39..91.) A description of the Trans-Canada communication system between the mainland and Vancouver Island (48 miles). The transmitting frequencies are 95.5 and 73.5 Mc/s, the deviation ±15 kc/s, and the transmitter power 50 W.

621.396.66 **192**

Automatic Fader.—Hunter. (*See* 65.)

621.396.712 **193**

Canada's International Short-Wave Plant.—H. M. Smith. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 112–116.) The new C.B.C. installation at Sackville, New Brunswick. This site was selected to be outside the magnetically-disturbed zone. Three antenna systems have been installed beamed on Europe, South America and Australia and, by reversal, on Central America and New Zealand, Eastern Asia, and South Africa. Each system comprises several arrays for 6, 9, 11, 15, and 17 Mc/s, of the driven curtain type, with non-driven reflectors. Each curtain consists of two side-by-side vertical stacks of four horizontal elements. Two 50 kW transmitters are used, and the service started in 1944.

621.396.712 : 621.396.61 **194**

2UE Broadcasting Station.—Stevenson. (*See* 240.)

621.396.8 **195**

Slow-Speed Relaying.—W. Stockman. (*Wireless World*, June 1945, Vol. 51, No. 6, p. 175.) A proposal for reducing noise interference with communications. Record the signal, *e.g.* on steel tape, transmit from the recording at about one-fifth the natural speed, record again at the receiving station, and afterwards reproduce this recording at the natural speed. By this process modulation frequencies would be reduced during transmission, so that narrower-band equipment could be used, with consequent reduction in noise level and in the effect of selective fading.

621.396.97 + 621.397 **196**

Developments in Radio and Television.—Baker. (*See* 222.)

621.396.97 : 356.251.11 **197**

Britain's Monitoring [of enemy broadcasts] **Service.** (*Wireless World*, July 1945, Vol. 51, No. 7, pp. 211–212.)

SUBSIDIARY APPARATUS

537.531 : 62 **198**

Discussion on " A Survey of X-rays in Engineering and Industry."—V. E. Pullin. (*J. Instn elect. Engrs*, Part I, Oct. 1945, Vol. 92, No. 58, pp. 390–395.) Discussion of 3431 of 1945.

537.531(091) **199**

The Discovery of X-rays.—J. A. Crowther. (*Electronic Engng*, Nov. 1945, Vol. 17, No. 213, pp. 755–758.)

621.526 : 621.391 **200**

The Servo Problem as a Transmission Problem.—E. B. Ferrell. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 763–767.) The analogy between the action of a servo and an amplifier is drawn. Many mechanical problems can be dealt with using electrical circuit analysis as described by Nyquist (1932 abstracts p. 279) and Bode (4231 of 1940).

621.314.2 **201**

High-Quality Communication and Power Transformers.—E. B. Harrison. (*J. Soc. Mot. Pict. Engrs*, Sept. 1944, Vol. 43, No. 3, pp. 155–167.) Low external fields are obtained from power transformers using astatically-balanced solenoids and narrow cores. The laminations have air gaps staggered in adjacent pairs to increase permeability. The large coil surface exposed allows twice the heat to be dissipated for half the usual chassis space with 3% drop in efficiency. Power chokes have air gaps between astatic coils, for low leakage. Harmonics are eliminated by arranging clamps and bolts so that little magnetic flux passes through them. Audio chokes following this design have Qs of 70 at 1 000 c/s.

The design is given of push-pull audio transformers for wide frequency range, with excellent balance and light weight. The output transformer uses many turns to keep flux density low, and a long magnetic path to obtain correct inductance. The high-impedance primary is sectionalised to reduce distributed capacity, the leakage reactance being reduced by surrounding the core with a copper eddy-current shield. Astatic coils reduce hum pick-up 30 db. A method of vacuum impregnation is described. A screened input transformer is described attenuating external fields 90 db.

621.314.2 : 536.2 **202**

Formulas for Calculating Temperature Distribution in Transformer Cores and Other Electric Apparatus of Rectangular Cross Section.—T. J. Higgins. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, April 1945, Vol. 64, No. 4, pp. 190–194.) Formulae are derived for the temperature distribution, the maximum temperature, and the average temperature in transformer cores and other electrical apparatus of rectangular cross section and of such general shape that the temperature distribution is essentially two dimensional. The theory is applied to a numerical example and checks well with experimental data. For discussion see *Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, June Supplement 1945, vol. 64, pp. 493–494.

621.314.2.08 **203**

Note on the Measurement of Transformer Turns-Ratio.—P. M. Honnell. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 808–809.) "This note shows that in many important cases the turns-ratio of iron-core transformers is given by the simple relation $N_1/N_2 = \sqrt{X_{sc1}/X_{sc2}}$, in which X_{sc1} and X_{sc2} are the reactive components of the short-circuit primary and secondary impedance of the windings concerned."

621.314.3 : 623.6 **204**

Some Fundamental Considerations in Military Amplifier Design.—S. L. Chertok. (*J. Soc. Mot. Pict. Engrs*, July 1944, Vol. 43, No. 1, pp. 10–18.) Outlines the requirements for shock-proof equipment operating under extreme conditions of temperature and humidity. Indicates the arrangement and design of components and the treatment of materials. Resistance to salt-spray and splash-proofing tests are described. Electrolytic capacitors and resistors are major problems. Components are mounted on terminal boards for easy servicing.

621.314.65 : 621.396.71 **205**

High-Voltage Steel-Tank Mercury-Arc Rectifier Equipments for Radio Transmitters.—J. C. Read. (*J. Instn elect. Engrs*, Part II, Oct. 1945, Vol. 92, No. 29, pp. 453–468. Discussion, pp. 490–494.) A detailed account of the design and development of equipments supplying 30–700 kW at 10–20 kV d.c. In all the cases dealt with arc suppression by grid control is used. The effect of the circuit on some of the factors affecting backfire at high voltages is briefly discussed. For application see 206.

621.314.65 : 621.396.71 **206**

The Application of High-Voltage Steel-Tank Mercury-Arc Rectifiers to Broadcast Transmitters.—P. A. T. Bevan. (*J. Instn elect. Engrs*, Part II, Oct. 1945, Vol. 92, No. 29, pp. 469–489. Discussion, pp. 490–494.) Review of B.B.C. practice, including a description of a recent type of pumpless air-cooled equipment. Analytical and design data for various types of rectifier connection used in practice, smoothing circuits, and grid-control features.

621.315.3 (23.03) **207**

Simulated-High-Altitude Testing of Aircraft Ignition Cables and Connectors.—H. H. Race & A. M. Ross, Jr. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, Jan. 1945, Vol. 64, No. 1, pp. 20–25.) Ignition systems requiring from 9–12.7 kV peak must have an arc-over voltage in excess of this for efficient operation of the sparking plugs. Other sources of failure are corona cutting of the cable insulation, water-vapour condensation, and thermal deterioration of the cable insulation. An electronic interrupter to simulate the magneto has been used to investigate the behaviour of various types of cable and connector assemblies when subjected to cycles of low pressure and high temperature. It was found that neoprene-sheathed cable was considerably better than lacquered-braid cable, and that sealing of the connector by a grommet was essential.

621.315.62 : 519.283 **208**

Statistical Methods applied to Insulator Development and Manufacture.—Taylor. (*See* 255.)

621.316.578.1 : 621.385.832 **209**

Controlling Activation Schedules at Exhaust.—M. Silverman. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 180..192.) A timer used for obtaining uniformity in the production of cathode-ray tubes.

621.317.7 **210**

Industrial Test Equipment Design.—Powell. (*See* 120.)

621.317.755 **211**

Midget CRO for Maintenance Technicians.—(*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 202..206.) Can operate from mains or 12V battery, with 15W consumption. 1½ inch diameter screen, brilliance and focusing controls, provision for intensity modulation. Plate sensitivity 4V/mm. Linear time base 20 c/s to 25 kc/s, with internal or external synchronisation. Single-stage amplifier with maximum gain 400 from 50 c/s to 10 kc/s.

621.319.42 (213) **212**

Glass-Sealed Capacitors.—V. J. Simson. (*Electronic Engng*, Nov. 1945, Vol. 17, No. 213, p. 780.) Normal types of tubular capacitor fail under tropical conditions or on long sea voyages; the glass-sealed type do not. The copper end cap requires special design to ensure that it yields slightly before breaking stresses are reached in the glass. Brief account of tests and results.

621.38 : 6 **213**

Electronic Applications in [U.S.] **Industry.**—W. Sommer. (*Electronic Engng*, Nov. 1945, Vol. 17, No. 213, pp. 777–779.) Nineteen thousand questionnaires were sent to subscribers to fourteen selected technical journals. An average of 21 electronic devices are used by each of the 796 firms that replied. The replies are analysed.

621.383.5 **214**

The Electromotive Force of the Selenium Barrier-Layer Photo-Cell.—R. A. Houstoun & A. F. Howatson. (*Phil. Mag.*, April 1945, Vol. 36, No. 255, pp. 279–287.) A selenium barrier-layer photo-cell may be regarded as having a constant e.m.f. which sends a current through a resistance inversely proportional to the intensity of illumination. (See 3641 of 1942 and back references.) This e.m.f. has been more accurately determined, and its variation with colour investigated. The e.m.f. usually increased from blue to red, contrary to the authors' expectations, and the effect is not explained. The effect of an applied (polarising) e.m.f. was investigated, and gave increased resistivity. The combined effect of light and polarising voltage is represented by an empirical formula with a theoretical basis over a limited range. The gain in sensitivity from the polarising voltage does not justify the extra trouble in operation.

621.386 **215**

A Modern X-ray Tube Factory.—A. G. Long. (*Electronic Engng*, Nov. 1945, Vol. 17, No. 213, pp. 772–774.) Materials must conform closely to specification, metals, for example, being spectrographically examined before acceptance as usable. High precision is required in electrode assembly. Special ventilation is provided in the glassworking section. Almost surgical cleanliness is maintained throughout, and handling reduced to a minimum during construction.

621.394.625.11 **216**

Construction of a Morse Recorder.—C. B. Pretty. (*R.S.G.B. Bull.*, Nov. 1945, Vol. 21, No. 5, pp. 72, 76.)

621.395.625.3.015.3 **217**

Frequency-Modulated Magnetic-Tape Transient Recorder.—H. B. Shaper. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 753–760.) The transient is recorded on a loop of steel tape driven by a synchronous motor so that the tape makes one revolution every 0.1 sec. A carrier frequency of 10 kc/s is continuously recorded on the tape and then removed on passing the obliterating head. When a signal arrives it modulates the carrier, but also fires a thyratron that quenches the obliterator. 0.1 sec later a second thyratron quenches the carrier, leaving a completed record which is then picked up, amplified and demodulated, and then applied to an oscilloscope with a 10 c/s time-base to give a steady image on the screen. The recorder has a frequency range of 0.02 to 1 000 c/s with some response at 2 000 c/s.

621.315.5 + 621.318.4] (021) **218**

Electric Coils and Conductors [Book Review].—H. B. Dwight. McGraw-Hill, N.Y., 351 pp., $5.00. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 418..422.) Comprehensive reference work on the design of inductors, transformers and conductors.

TELEVISION AND PHOTOTELEGRAPHY

621.314.3 + 621.383 + 621.396.62 **219**

The State of Development and Physical Limit [of sensitivity] **of Communication Devices, Radiation Converters and Radiation Storage Devices.**—Schäfer (*See* 166.)

621.383.5 **220**

The Electromotive Force of the Selenium Barrier-Layer Photo-Cell.—Houstoun & Howatson. (*See* 214.)

621.396.24 : 621.397.26 **221**

V.H.F. Multiple-Relay Television Network.—Bingley. (*See* 187.)

621.397 + 621.396.97 **222**

Developments in Radio and Television.—W. R. G. Baker. (*Elect. Engng, N.Y.*, April 1945, Vol. 64, No. 4, pp. 152–155.) The problems to be faced in providing sound and television broadcast facilities throughout the United States are discussed in relation to recent technical advances. Reference is made to the potentialities of f.m. broadcasting for providing small communities with a satisfactory service. Stress is laid on the importance of "capture effect" in reducing the width of the frequency band necessary to give such a service.

621.397 **223**

Television Broadcasting Practice in America—1927 to 1944.—D. G. Fink. (*J. Televis. Soc.*, March 1945, Vol. 4, No. 5, pp. 112–118.) Long summary of 3955 of 1945.

621.397 : 654.17 **224**

The Television Committee's Report.—(*J. Televis. Soc.*, March 1945, Vol. 4, No. 5, pp. 98–99.) Summary of and extracts from the Hankey report. See also 3002 of 1945.

621.397 : 654.17 **225**

"Television Committee's Report."—R. W. Hallows. (*Wireless World*, July 1945, Vol. 51, No. 7, pp. 207–208.) A reply to 3001 of 1945 and 228 of January criticising 2254 of 1945.

621.397.26 **226**

Scrambled Television.—(*J. Televis. Soc.*, June 1945, Vol. 4, No. 6, pp. 135, 142.) The summary of a patent which makes it possible for a television programme to be picked up by subscribers only. Regularly spaced frame synchronising signals are used for the frame scan, but irregularly spaced ones for the line scan, both at the transmitter and the receiver. Only the former are transmitted, the latter being supplied at the receiver.

621.397.3 **227**

Remarks on Colour Television.—(*J. Televis. Soc.*, Mar. 1945, Vol. 4, No. 5, p. 123.) Summary of Dr. P. C. Goldmark's evidence before the F.C.C.

621.397.5 **228**

Television "Fallacies".—C. W. Sheffield. (*Wireless World*, June 1945, Vol. 51, No. 6, p. 181.) Letter criticising 2254 of 1945.

621.397.5 **229**

Studio Technique in Television.—D. C. Birkinshaw & D. R. Campbell. (*J. Televis. Soc.*, June 1945, Vol. 4, No. 6, pp. 136–142.) Abridged version of 3961 of 1945.

621.397.5 **230**

A New Television System.—Pye, Ltd. (*Electrician*, 16th Nov. 1945, Vol. 135, No. 3520, p. 540.) Sound and television are broadcast on the same frequency by transmitting the sound during the vision "fly-back" time when no vision signals are transmitted. With the present television definition

10 125 sound pulses are transmitted per second. This system reduces the cost of the transmitter and the receiver, the possibility of interference between sound and vision in the receiver is eliminated, automatic volume control can be used to ensure a steady picture, and colour television and stereophonic sound should be easier to achieve. See also *Nature, Lond.*, 10th Nov. 1945, Vol. 156, No. 3967, p. 565.

621.397.62 **231**

The Television Receiver Sound Channel.—(*J. Televis. Soc.*, March 1945, Vol. 4, No. 5, p. 122.) Summary of discussion at meeting of Radio Section I.E.E. on 19th Dec. 1944.

621.397.62 **232**

Better Television.—(*Sci. Amer.*, June 1945, Vol. 172, No. 6, pp. 362–363.) Improvements in projection, incorporating plastic mirrors and lenses, have made possible the reproduction, at reasonable cost, of pictures which are brighter, clearer and larger than those available on pre-war sets. Other improvements are a high-voltage cathode ray tube and circuits to discriminate against noise.

621.397.62 **233**

Separating Sound from Vision in Television Reception.—K. R. Sturley. (*J. Televis. Soc.*, March 1945, Vol. 4, No. 5, pp. 100–111.) A description of the problems, and "an examination . . . of the design of the i.f. stages of a superheterodyne receiver for accepting one of several vestigial sideband television transmissions, which may be adjacent one to the other". Also, "a survey, illustrated by numerical examples, of the methods of preventing interference with the vision programme from its associated, and an adjacent, sound signal. The absorber type of filter, also used as a pick-up circuit for the associated sound programme, is treated in detail, as is the parallel resonant circuit-capacitance voltage divider, the series resonant and series-parallel resonant shunt filter. Reference is made to the possibilities of a resonant coupling in the i.f. transformer, and of cathode feedback."

621.397.62 **234**

Restorer-Circuit Operation.—Last. (*See* 67.)

654.17 **235**

The Social Function of Television.—W. H. Cazaly. (*J. Televis. Soc.*, June 1945, Vol. 4, No. 6, pp. 130–134.) Two important aspects of television are simultaneity of perception with occurrence, and the consequent psychological influence. The former can be exploited with advantage by industry, but also by unscrupulous politicians, and the latter provides satisfaction to the herd instinct by allowing wider participation in events. Television can play a big part in the drift towards co-prosperity if correctly controlled, but if not it can become "a greater curse than any that has inflicted mankind".

TRANSMISSION

621.395.44 **236**

Wide-Band Program-Transmission Circuits.—E. W. Baker. (*Elect. Engng, N.Y.*, Mar. 1945, Vol. 64, No. 3, pp. 99–103.) To utilise the high-fidelity characteristics of frequency modulation, wide-frequency-band circuits are necessary between studio and transmitter, and between network stations. The existing programme networks usually have 5 kc/s band widths, but networks with band widths of 15 kc/s or more can be supplied if required.

621.396.029.63/.64 **237**

Microwave Techniques.—Jenks. (*See* 185.)

621.396.6 : 629.13 **238**

The Marconi General Purpose Aircraft Wireless Equipment.—J. L. Scott. (*Marconi Rev.*, Jan./Mar. 1945, Vol. 8, No. 76, pp. 1–11.) The T1154/R1155 equipment is designed to provide transmission by c.w., m.c.w. and r.t. over the frequency ranges 0.2 to 0.5 and 3 to 10 Mc/s, reception over the ranges 0.075 to 0.5, 0.6 to 1.5, and 3 to 18.5 Mc/s, and direction finding over the ranges 0.6 to 1.5, and 3 to 18.5 Mc/s.

The transmitter weighing 45 lb comprises a master oscillator driving a power amplifier giving an output of 80 W on c.w. and 35 W on m.c.w. or r.t. The receiver weighing 26 lb gives an output of 50 mW with an input of about 10 μV, uses an intermediate frequency of 560 kc/s, and has a band width of 5 kc/s. The d.f. equipment includes a visual indicator consisting of a twin-needle instrument; intersection of the needles is controlled by rotation of the loop, the bearing on the loop scale being observed when the needle intersection occurs on the scale centre. Homing is carried out by locking the loop athwartships, permitting the pilot to direct the course so as to bring the needle intersection to the scale centre.

621.396.61 **239**

Stepping Up Transmitter Power from 500 W to 1 kW.—L. A. Reilly. (*Communications*, Sept. 1945, Vol. 25, No. 9, pp. 42..90.) How the power of the WSPR transmitter was increased from 500 W to 1 kW without interrupting the service. An entirely new 1 750 V power supply was needed and a complete circuit diagram of this and of the whole transmitter is given.

621.396.61 : 621.396.712 **240**

2UE Broadcasting Station.—M. H. Stevenson. (*Proc. Instn Radio Engrs, Aust.*, July 1945, Vol. 6, No. 1, pp. 3–11.) Detailed description of a 1 000 W a.m. transmitter in Sydney, N.S.W. Wavelength not stated. The aerial is a self-supporting quarter-wave radiator with a ground system of 120 radial wires each half a wavelength long.

621.396.615.12 **241**

Design of Stable Heterodyne Oscillators.—J. B. Moore. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 116–118.) A compensation for temperature effects to better than 10 parts in a million per degree centigrade is claimed, by balancing the negative coefficient of the inductor against a positive coefficient given by a specially-designed variable capacitor, having rotor plates of copper-plated invar and a stator with plates and separators of different metals, and ceramic end plates. Residual changes due to stray and fixed capacitances are balanced by small compensating solid-dielectric capacitors. The stabilisation is apparently relative to fairly slow drifts of ambient temperature. The oscillator has a 2 to 1 tuning range about 24 Mc/s.

621.396.615.17 **242**

Theory of Synchronization of Relaxation Auto-Oscillatory Systems.—Theodorchik. (*See* 111.)

621.396.67 : 621.317.384.029.56/.58 **243**

A Proposed Standard Dummy Antenna for Testing Aircraft-Radio Transmitters.—C. Stewart, Jr. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 772–777.) The antenna consists of 35ft of coiled coaxial cable with copper cooling fins between turns, and terminating with an r.f. milliammeter or diode. Characteristics simulate those of aircraft antennae for the range 2–30 Mc/s. Maximum power dissipation 125 W.

VALVES AND THERMIONICS

537.583 : 621.3.032.216 **244**

Pulse Emission Characteristics of Oxide Cathodes.—R. L. Sproull. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 270..278.) Summary of 2642 of 1945.

621.385 + 621.386](091) **245**

Electronics and Development of Electronic Tubes.—I. E. Mouromtseff. (*J. Franklin Inst.*, Sept. 1945, Vol. 240, No. 3, pp. 171–192.) An historical survey of the development of various types of electron tubes from the earliest discharge tube, and their applications to industry. Electron Beam Tubes: the Lenard, Roentgen and cathode ray tubes were developed directly from Crookes' discharge tube. Mercury Vapour Tubes: includes a detailed description of a modern mercury arc rectifier (ignitron) and its method of working. High Frequency Tubes: development of high-power tubes for radio and industrial applications. Ultra High Frequency Tubes: description of typical u.h.f. tubes (Types 880 and 530) and applications of dielectric heating to industry. Super High Frequency Tubes: brief description of the development of the magnetron and velocity-modulated tubes, and their possible future applications. An extensive historical bibliography is given.

621.385 **246**

Valve Colour Code?—K. E. Marcus. (*Wireless World*, June 1945, Vol. 51, No. 6, pp. 181–182.) Proposed use of six colours to indicate heater voltage and current.

621.385 **247**

Recent Electron-Tube Developments.—S. B. Ingram. (*Elect. Engng, N.Y.*, Jan. 1945, Vol. 64, No. 1, pp. 22–24.) Special valves developed for carrier-system long-distance telephones, which require valves with high transconductance, low input and output capacitance, and long life with low filament consumption; and for radio-telephone systems where small transit time, duplicate anode and grid leads, and short electrode leads are needed. Thyratrons, with a mixture of mercury vapour and a rare gas, are used in regulated rectifiers for battery chargers. Cold-cathode gas-filled valves, giving many years of trouble-free service, find many applications in telephone systems.

621.385 **248**

Postwar Electron Tube Business.—W. C. White. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 92–97.) It is estimated that about ten million pounds worth of tubes of all types were manufactured annually between 1935 and 1939, and that for the immediate post-war period the annual demand is likely to be about twenty million pounds worth.

621.385.012.8 **249**

"Valve Vectors."—D. H. Parnum: K. R. Sturley. (*Wireless World*, July 1945, Vol. 51, No. 7, pp. 209–210.) Parnum criticises 2179 of 1945, and Sturley replies.

621.385.832 **250**

Characteristics of Luminescent Materials for Cathode Ray Tubes.—(*J. Televis. Soc.*, June 1945, Vol. 4, No. 6, pp. 143–144.) Summary of a discussion by the Radio Section I.E.E., led by C. G. A. Hill.

621.385.832 : 621.316.578.1 **251**

Controlling Activation Schedules at Exhaust.—M. Silverman. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 180..192.) A timer used for obtaining uniformity in the production of cathode-ray tubes.

621.38 **252**

Theory and Applications of Electron Tubes [Book Review].—H. J. Reich. McGraw-Hill, N.Y. & London, 2nd edn. 1944, pp. 716, $5. (*Elect. Engng, N.Y.*, May 1945, Vol. 64, No. 5, p. 205.)

621.38 **253**

An Introduction to Electronics [Book Review].—R. G. Hudson. Macmillan, N.Y., 1945, 97 pp., $3.00. (*Sci. Mon., N.Y.*, Aug. 1945, Vol. 61, No. 2, p. 158.) ". . . for the lay reader."

MISCELLANEOUS

001.891 : 6 **254**

Research—Creator of Employment.—A. W. Hull. (*Elect. Engng, N.Y.*, Jan. 1945, Vol. 64, No. 1, pp. 25–27.) Properly directed research, by developing new products and more efficient processes, promotes progress, combats unemployment, and raises the general standard of living.

519.283 : 621.315.62 **255**

Statistical Methods Applied to Insulator Development and Manufacture.—J. J. Taylor. (*Trans. [mon.] Amer. Inst. elect. Engrs*, July 1945, Vol. 64, No. 7, pp. 495–498.) Quality control in high-voltage insulator manufacture, and the use of associated scientific data for estimation and prediction purposes.

620.193.7(213) : 621.315.5 : 621.315.6 **256**

Electrolytic Corrosion—Methods of Evaluating Insulating Materials used in Tropical Service.—B. H. Thompson & K. N. Mathes. (*Trans. [mon.] Amer. Inst. elect. Engrs*, June 1945, Vol. 64, No. 6, pp. 295–299.) Laboratory tests are made with 100% relative humidity and dew at 35°C. The insulating material in sheet form is rolled round glass rods, and two coils one inch apart, each of three turns of copper wire, are wound on to it, 120 volts d.c. are applied between the coils for periods of up to 7 days, and corrosion is detected by periodic visual examination. Alternatively the current between the electrodes is measured. Typical results for a number of materials are given. An appendix deals with the factors influencing electrolytic corrosion. For discussion see *Trans. [mon.] Amer. Inst. elect. Engrs*, June Supplement 1945, Vol. 64, pp. 443–444.

ABSTRACTS AND REFERENCES

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In order to enhance the usefulness of the abstracts, certain changes have been made in their presentation. The subject sections have been increased in number and made more in accordance with the modern trend of development, and they are now arranged in alphabetical order. Universal Decimal Classification numbers have been added to each abstract, and heavy-face type has been adopted for the serial number and title in order to increase their legibility.

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ACOUSTICS AND AUDIO-FREQUENCIES

534.213.4 **257**

Attenuation of Sound in Circular Ducts.—E. Fisher. (*J. acous. Soc. Amer.*, Oct. 1945, Vol. 17, No. 2, pp. 121–122.) A method alternative to that of Molloy and Honigman (2677 of 1945) for calculating the attenuation constants. Good agreement between the results of the two methods is noted.

534.321.9 : 621.396.9 **258**

Acoustic Control in the Flight of Bats.—H. Hartridge. (*Nature, Lond.*, 27th Oct. 1945, Vol. 156, No. 3965, pp. 490–494.) Experiments show that bats, while flying, emit a discontinuous supersonic note that enables them to detect obstacles by observing the echo. The sensitivity of hearing is depressed during the emission of the supersonic pulse, and restored to receive the echo. There are close analogies with radar.

534.86 **259**

"Higher Fidelity" in Sound Transmission and Reproduction.—G. M. Nixon. (*J. acous. Soc. Amer.*, Oct. 1945, Vol. 17, No. 2, pp. 132–135.) A discussion of factors which include (*a*) lack of knowledge of absorbent properties of acoustic materials outside the range 128–4 096 c/s (*b*) absorption by the air at frequencies above 4 000 c/s (*c*) acute hearing loss for frequencies above 2 000 c/s with advancing age.

534.862 **260**

The Technique of Production [film] **Sound Recording.**—H. G. Tasker. (*J. Soc. Mot. Pict. Engrs*, Oct. 1942, Vol. 39, No. 4, pp. 213–227.) Mainly a description of the use and placement of directional microphones, and the effect of acoustical factors such as reflections.

621.394/.396].645.33 **261**

AC/DC Quality Amplifier.—(*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 354–357.) Output 2 W, negative feedback. Design and construction, including construction of output transformer.

621.394/.396].645.33 **262**

Improved Driver Stages for Class-B [a.f.] **Amplifiers.**—E. A. Henry. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 45–50, 118.) Use of the cathode-follower circuit for this purpose gives "practically perfect" regulation, large damping factor, low distortion, and wide frequency range. The relevant design principles are described, with typical examples.

621.394/.396].645.33 **263**

Parallel Tube High Fidelity Amplifier.—F. C. Jones. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 27–29.) Parallel-tube amplifiers may be designed to give a few watts output with less distortion than is produced by push-pull types having the same output. Design data are given for amplifiers using output stages of two paralleled beam power tetrodes with negative feedback.

621.395.623 **264**

A General Theory of Passive Linear Electroacoustic Transducers and the Electroacoustic Reciprocity Theorem. I.—L. L. Foldy & H. Primakoff. (*J. acous. Soc. Amer.*, Oct. 1945, Vol. 17, No. 2, pp. 109–120.) "A theory of the operation of passive linear electroacoustic transducers is developed on the basis of the most general linear equations (in this case, integral equations) relating the pressure and normal velocity at each point on the transducer surface and the voltage and current at the transducer's electrical terminals. These, together with the appropriate solutions of the wave equation expressed through the use of Green's functions for the medium in which the transducer is immersed and the equations defining the electrical termination of the transducer, completely characterize the behaviour of the transducer, and allow explicit calculation of such quantities as impedances, responses, etc., in terms of four parameters entering the fundamental equations.

"On the basis of this theory, a proof of the reciprocity theorem for electroacoustic transducers relating their speaker and microphone responses is presented embodying the conditions necessary for its validity. These conditions are essentially the existence of certain symmetry relationships among the transducer parameters. When these symmetry relationships may be expected to hold is to be discussed in Part II of this paper to appear later. Some applications of the theory are presented and others are outlined."

621.395.623 **265**

The Electroacoustic Four-Pole Transducer as an Acoustic Transmitter.—J. Müller-Strobel. (*Arch. Elektrotech.*, Jan./Feb. 1944, Vol. 38, Nos. 1/2, pp. 62–90.) The forces due to reaction of the sound field are introduced into the equations of motion of the diaphragm of a telephone receiver. Separation of the mechanical, electrical, and acoustic terms is consequently obtained, so that it is unnecessary to represent acoustic forces by effective added mass, stiffness, or damping. A damping proportional to diaphragm velocity is introduced as equivalent to the material and frictional damping proportional to displacement. This is permissible for small amplitudes.

Measurements were made on specially constructed earphones to find the relationship betweeen transducer impedance and acoustic reaction forces. The instruments were measured in a vacuum, with and without locking of the armature, giving the no-load impedance. The armature velocity and the phase-angle between the magnetic forces and the armature deflection are determined from the equations. The condition of resonance gave the polar moment of inertia of the cone-shaped diaphragm clamped at the edges.

The e.m.f. induced in the coil is determined, and the corresponding impedances calculated. Ohmic resistance, and eddy-current and hysteresis losses, experimentally determined, are represented by equivalent resistances. Measurements on transducers of two types showed the no-load running impedance to be partly dependent on current and partly independent of it. Current-dependence was only found near resonance, *i.e.*, for greatest mechanical deviation, and further investigation was confined to conditions giving impedances independent of current.

Figures are given for the stiffness of the diaphragm and for the torsional restoring couple on the armature. To determine the mechanical damping coefficients it is assumed that the change in exciting force with frequency has no effect on the form of the resonance curve. This is justified for small damping.

A survey of the behaviour of acoustic forces is obtained from measurements of impedance in a free sound field. A general expression is given for the relationship between the change in impedance and the acoustic force of the sound field causing it. This has a simple form in a free field, but was very complicated for the transducers used, as the cavities around the diaphragms, with their different resonant frequencies, substantially affected the sound field. The force can, however, be resolved into its component parts, so that the constructional features of the transducer can all be considered mathematically.

621.395.623.34 **266**

The Conical Sound Source.—P. G. Bordoni. (*J. acous. Soc. Amer.*, Oct. 1945, Vol. 17, No. 2, pp. 123–126.) The formula for the acoustic pressure due to a rigid cone axially vibrating in an infinite baffle, deduced by W. N. Brown (130 of 1942) is developed in the form of rapidly converging series. This enables directional and response curves to be plotted. It is found that "The pressure radiated by a mass-controlled cone decreases on the axis as frequency increases, instead of keeping constant, as it does with a disk. The directional curves are like those of a disk of the same radius, but a little flattened."

621.395.623.7/.8 **267**

The Quarter-Wave Method of Speaker Testing.—S. L. Reiches. (*J. Soc. Mot. Pict. Engrs*, May 1942, Vol. 38, No. 5, pp. 457–467.) A pulse roughly equivalent to a quarter of a sine wave, generated by discharging a condenser through a resistance, is used to excite the loudspeaker under test. The acoustic output is received by a microphone, and a reading of peak voltage is made.

621.395.623.7 **268**

The Moving Coil Loudspeaker.—G. R. Cooper. (*Overseas Engr*, Nov. 1945, Vol. 19, No. 218, pp. 45–48.) An elementary account of the causes of resonance. Improvements in response may be obtained by the use of baffles and also by introducing corrugations into the cone. It is hoped that the efficiency of loudspeakers will be increased by the use of new materials.

621.395.623.8 : 534.846.4 **269**

On the Acoustic Conditions and Preliminary Calculation for Setting Up Several Loudspeakers.—M. W. Matschinsky. (*Arch. Elektrotech.*, Jan./Feb. 1944, Vol. 38, Nos. 1/2, pp. 57–61.) Consideration of the physical and mathematical conditions for undistorted and good-quality hearing of speech and music. There must be no acoustically dead spots, and each sound reproduced by the system must be heard once only at any point in the area served. The following formulae are derived from the relationship between the field strength and time delay of a signal from a loudspeaker. For loudspeakers in the open, max $R = 1.5\ c\,\Delta t_{\text{rev.}}$, where R is the distance between two loudspeakers, c the velocity of sound in air, and $\Delta t_{\text{rev.}}$ the optimum reverberation time. In an enclosed space, max $R \doteqdot 1.5\ c\ (\Delta t_{\text{rev.}} - \Delta t_{\text{rev. tats}})$ where $\Delta t_{\text{rev. tats}}$ is the actual reverberation time of the space considered.

621.395.625.2 **270**

Business Recording Equipment.—R. Stone. (*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 32.. 106.) The requirements of an office recording-reproducing system are formulated and the Sound-Scriber equipment, using thin vinylite disks and the embossed-groove process, is described.

621.395.625.6 **271**

Some Practical Aspects of the Intermodulation Test [for sound films].—E. Meschter. (*J. Soc. Mot. Pict. Engrs*, Sept. 1945, Vol. 45, No. 3, pp. 161–170.) Effect of film density on intermodulation.

621.395.625.6 **272**

A Frequency-Modulated Control-Track for Movietone Prints.—J. G. Frayne & F. P. Herrnfeld. (*J. Soc. Mot. Pict. Engrs*, Feb. 1942, Vol. 38, No. 2, pp. 111–123, Discussion pp. 123–124.) "A 5-mil frequency-modulated track located between sound and picture areas is proposed to control reproduction in the theater from one or more soundtracks. A variation of approximately one octave in the control frequency provides a 30-db change in volume range which may be used in part for volume expansion of loud sounds or as noise reduction for weak sounds. The control-track frequency is varied manually and recorded simultaneously with the sound-track in the dubbing operation, the gain of the monitoring channel being varied in accordance with the control frequency to produce automatically the enhanced volume range desired from the release print."

621.395.625.6 **273**

Design and Use of Noise-Reduction Bias Systems [for sound-film equipment].—R. R. Scoville & W. L. Bell. (*J. Soc. Mot. Pict. Engrs*, Feb. 1942, Vol. 38, No. 2, pp. 125–147.) The improvement in film background-noise afforded by the biased recording method depends on the fact that noise is reduced when the average light transmitted through the film is held to the lowest usable value. This condition is obtained by partially closing the shutter of the light valve during quieter intervals, by means of a superimposed bias current; but this introduces undesirable noise components which, however, can be greatly reduced by the use of fine-grain sound films, and by pre-emphasis of the higher frequencies in recording, and subsequent attenuation in reproducing. Variable-area records have less noise than variable-density ones. Circuit diagrams suitable for bias recording are given together with photographs of a noise reduction unit.

621.395.665 **274**

Elimination of Relative Spectral Energy Distortion in Electronic Compressors.—B. F. Miller. (*J. Soc. Mot. Pict. Engrs*, Nov. 1942, Vol. 39, No. 5, pp. 317–323.) "The exaggeration of sibilant speech-sounds produced when electronic volume compression is employed in sound-recording channels is shown to be a form of amplitude-selective frequency distortion, which is generated by virtue of the normal mode of operation of the compressor. The practical elimination of this form of distortion is accomplished by equalization of the compressor control-rectifier input circuit, the amount of equalization employed being proportional to the inverse average relationship between rms speech-pressure per cycle and speech component frequency."

621.395.665.1 **275**

Volume Expansion.—J. G. White. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 24–25.) Summary of 3489 of 1945.

621.395.92 **276**

Tentative Code for Measurement of Performance of [air conduction] **Hearing Aids.**—Committee of the American Hearing Aid Association. (*J. acous. Soc. Amer.*, Oct. 1945, Vol. 17, No. 2, pp. 144–150.) "It is believed that these specifications represent the best of present practice, although additions may be made later to cover further material . . . [on which sufficient information is not yet available]."

621.396.615.11 **277**

Resistance-Capacity Oscillator.—F. G. Clifford. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 16..18.) Summary of 2989 of 1945.

621.396.62 **278**

A 21-Tube All-Purpose Receiver.—Marshall. (*See* 407.)

621.396.645.33 **279**

Audio Section Design Data for Battery Operated Receivers.—Sylvania Electric Products, Inc., Engineering Dept. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 36–37.) In battery-operated receivers it is desirable to secure uniform efficiency over a wide range of h.t. voltages. Optimum circuit values for a typical R-C coupled audio amplifier drive stage using a 1LD5 valve are given with graphs and a table showing performance over a range of operating conditions and circuit constants.

534.321.9 **280**

Der Ultraschall und seine Anwendung in Wissenschaft und Technik [Book Review].—L. Bergmann. VDI-Verlag, Berlin, 3rd edn. 1942, RM 25. (*Naturwissenschaften*, Feb./Mar. 1944, Vol. 32, Nos. 5/13, p. 91.) A comprehensive work.

AERIALS AND TRANSMISSION LINES

621.315.1 : 621.396.67 **281**

Power for Aerials.—F. C. McLean & F. D. Bolt. (*Elect. Rev., Lond.*, 7th Dec. 1945, Vol. 137, No. 3550, pp. 825–826.) Short report of a paper read to the Radio Section of the I.E.E., on the design and use by the B.B.C. of various types of open-wire power lines for feeding aerials at frequencies ranging from 0.2 to 25 Mc/s. "Attenuation must be minimized even at the cost of heavier transmission lines." The four-wire line is now in general use for powers above 50 kW.

621.315.2 **282**

Some New Features of Low-Voltage Cable.—Madsen & McKinley. (*See* 341.)

621.315.212.1 : 621.316.54 **283**

A Simple Coaxial Switch.—E. Burgess. (*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 58, 60.) The construction of a switch for connecting a common coaxial feeder to alternative aerials.

621.392 **284**

Waves and Wave Guides.—G. G. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 54–58.) A simple educational article. The complex wave-patterns in waveguides are described in terms of combinations of plane waves incident on and reflected from the surfaces of the guide.

621.396.67 **285**

Demonstrating the Properties of Aerials.—(*Electronic Engng*, Dec. 1945, Vol. 17, No. 214, pp. 800–805, 835.) An oscillator giving about 45 W output at 130 Mc/s is used to feed transmission lines and aerial systems. The current and voltage distributions are shown by detecting devices such as lamps or crystals used with deflecting instruments. 18 figures show numerous demonstrations.

621.396.67 **286**

RCA's Antennalyzer.—G. H. Brown. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 223, 226.)

The impedances of the elements of an aerial array are represented by adjustable interrelated circuits fed from the same r.f. source. The equivalent of directional response is represented on a c.r.t. indicator, so that the required amplitude and phase of feed currents can be deduced, thereby eliminating laborious and approximate theoretical solutions.

621.396.67 **287**
Technic of Antenna Gain Measurements.—G. Glinski. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 88..223.) An outline of basic equipment and arrangements required for v.h.f. work. The gain of a transmitting aerial is measured at the receiving point relative to a half-wave transmitting dipole fed with the same power. The insertion of a slotted section in the coaxial feeder permits the measurement of the standing wave in the line in order to obtain a measure of the power delivered to the aerial in the two cases. Graphical aids to computation are given.

621.396.67 : 621.317.33 **288**
Aerial Impedance Measurements.—L. Essen & M. H. Oliver. (*Wireless Engr*, Dec. 1945, Vol. 22, No. 267, pp. 587–593.) The impedances of various cylindrical and conical aerials were measured by the resonant line method and are presented graphically. The dependence of the properties of a cylindrical dipole on its diameter is shown. The impedances of a conical unipole with a reflecting sheet and of a conical dipole are shown for the frequency range 200–1 000 Mc/s. The apparent impedance of a cylindrical dipole fed from a concentric cable with and without a $\lambda/4$ balancing transformer is investigated. The accuracy of measurement is limited by reflections from nearby objects and by stray capacitances, and it tends to be poor when the measured resistance is of the same order as the characteristic impedance of the measuring line. For the measuring apparatus see 1113 and 3973 of 1945. See also 3525 and 3605 of 1945.

621.396.674 **289**
Airloop Antenna.—(*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, p. 114.) A novel manufacturing process, whereby a multiturn loop is pressed out of a copper sheet onto a supporting insulating sheet, results in a loop of high Q, because the formed turns stand out in inverted-V fashion and are substantially air-spaced.

621.396.677 **290**
Antenna.—C. W. Hansel. (*Radio*, Oct. 1945, Vol. 29, No. 10, p. 39.) Combination of two V-antennae to obtain a directive system with broad-band characteristics. Summary of U.S. Patent No. 2 379 706.

621.396.677 **291**
Polar Diagrams for Antennas.—J. S. McPetrie, L. H. Ford & J. A. Saxton. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 170, 174.) Summary of 2612 of 1945.

621.392 **292**
High Frequency Transmission Lines [Book Review].—W. Jackson. Methuen, London, 1945, 152 pp., 6s. (*Nature, Lond.*, 9th June 1945, Vol. 155, No. 3945, p. 681.) The author "has supplied a real need by providing a convenient and reasonably comprehensive monograph . . ."

CIRCUITS

621.3.011 : 531 **293**
Electromechanical Analogies.—A. Bloch. (*Nature, Lond.*, 4th Aug. 1945, Vol. 156, No. 3953, pp. 151–152.) Brief account of 3277 of 1945.

621.3.012.3 : 621.3.017.21 **294**
Loss due to Series Resistance between Matched Source and Sink.—(*Radio*, Oct. 1945, Vol. 29, No. 10, p. 38.) Chart with explanatory diagram.

621.314.2 **295**
Methods of Driving Push-Pull Amplifiers.—(*Electronic Engng*, Dec. 1945, Vol. 17, No. 214, pp. 816–817.) Four diagrams show the transformer, triode phase-splitter, paraphase, and "out-of-balance" methods.

621.314.2 : 578.088.7 **296**
Biological Amplifiers—2.—D. H. Parnum. (*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 373–376.) Two-valve compressor stages are described for connecting a push-pull input stage to a single-ended amplifier. Interstage coupling for good l.f. response and the advantages of battery power supply are discussed, and the conclusions are applied to a suggested design for a complete amplifier. For part 1 see 45 of January.

621.392.4 **297**
Historic Firsts : Balancing Networks.—(*Bell Lab. Rec.*, Nov. 1945, Vol. 23, No. 11, pp. 412–413.) In early repeater stations loaded artificial lines were used to balance the impedance of real lines.

621.392.5 **298**
[Isolating] **Network Design.**—J. K. Mackenzie. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 20..24.) Summary of 3822 of 1945.

621.392.52 **299**
Preferred Numbers [and filter design].—M. N. McLean. (*Wireless Engr*, Dec. 1945, Vol. 22, No. 267, p. 594.) A letter pointing out an error in 3823 of 1945 (H. Jefferson) and Jefferson's reply.

621.394/.396].645.33 **300**
Improved Driver Stages for Class-B Amplifiers.—Henry. (*See* 262.)

621.394/.396].645.33 **301**
AC/DC Quality Amplifier.—(*See* 261.)

621.394/.396].645.33 **302**
Parallel Tube High Fidelity Amplifier.—Jones. (*See* 263.)

621.395.665 **303**
Elimination of Relative Spectral Energy Distortion in Electronic Compressors.—Miller. (*See* 274.)

621.395.665.1 **304**
Volume Expansion.—J. G. White. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 24–25.) Summary of 3489 of 1945.

621.396.611.3 **305**
Know Your Coupled Circuits.—D. Espy. (*QST*, Oct. 1945, Vol. 29, No. 10, pp. 76–80.) The double-tuned transformer is analysed and easy reference charts are given.

621.396.615.11 **306**

Resistance-Capacity Oscillator.—F. G. Clifford. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 16..18.) Summary of 2989 of 1945.

621.396.615.17 **307**

The Equivalent Circuit of the Multivibrator.—G.W.O.H. (*Wireless Engr*, Dec. 1945, Vol. 22, No. 267, pp. 573–575.) Discussion of the treatment of the multivibrator by Kiebert and Inglis (3494 of 1945) in which the valves are represented by switched resistances. The charge and discharge processes are conveniently calculated by the application of Helmholtz's (Thévenin's) theorem. The effect of grid current is approximately represented by the switching of a 1 000 Ω resistance in a typical numerical example. The method enables observed wave-forms to be readily interpreted.

621.396.615.17 : 621.317.755 **308**

Time-Base Converter.—H. Moss. (*Wireless Engr*, Dec. 1945, Vol. 22, No. 267, p. 593.) Letter acknowledging anticipation of 3266 of 1945 in a B.B.C. patent (B.P. 566 102).

621.396.616 **309**

On the Forced Electromagnetic Oscillations in Spherical Resonators.—Rydbeck. (*See* 320.)

621.396.619 **310**

The Input and Efficiency of Class B Modulators.—R. M. W. Grant. (*Marconi Rev.*, July/Sept. 1945, Vol. 8, No. 78, pp. 96–104.) "It is shown that even with linear characteristics the level of quiescent anode current has an important bearing on the distortion produced, and that bottom-bend curvature of the valve characteristics reduces this distortion. Valve rating is also discussed." Measurements are described, made on a pair of CAT 20 valves at 1 kc/s with output powers in the range 9 to 76 kW.

621.396.619.1 **311**

Keying of Radio Frequency Transmitters.—Wassell. (*See* 480.)

GENERAL PHYSICS

534.13 **312**

Wave Equations for Finite Elastic Strains.—H. M. James & E. Guth. (*J. appl. Phys.*, Oct. 1945, Vol. 16, No. 10, pp. 643–644.) Brief note suggesting error in 2822 of 1945 (Nadai).

535.3 + 621.396.11 **313**

An Exact Theoretical Treatment of Reflection-Reducing Optical Coatings.—R. L. Mooney. (*J. opt. Soc. Amer.*, Sept. 1945, Vol. 35, No. 9, pp. 574–583.) Exact formulae for reflectivity, R, and transmittivity, T, are obtained by treating the problem as a boundary problem in electromagnetic theory. General formulae for R and T are given for coatings consisting of a single homogeneous transparent film of uniform thickness. Formulae are also given for the minimum reflectivity for a monolayer coating and for the values of R and T for a beam of light perpendicularly incident on a plane surface of a transparent medium covered by two transparent homogeneous films of different thicknesses and indices of refraction. The general expressions for R and T for two-layer coatings are given, and it is shown that a maximum value of T is obtained when the thickness of each coating is one quarter-wavelength.

538.566.2 : 535.338 **314**

The Doppler Effect in a Refracting Medium.—I. M. Frank. (*Bull. Acad. Sci. U.R.S.S.*, Sér. phys., 1942, Vol. 6, Nos. 1/2, pp. 3–31. In Russian.) The radiation in the optical range of the spectrum from an oscillating electrical dipole (excited atom) moving in a uniform refracting medium is considered. In the method used a moving source of light, radiating spherical waves from different points of its trajectory, is replaced by a number of stationary sources radiating light impulses at definite instants. The theory of the method is discussed, and the Doppler formula (3,4) is derived, which differs from the usual formula (1,1) by the inclusion of the refractive index. A qualitative analysis of the mathematical interpretation is given and the intensity distribution of the radiation spectrum is examined. The case of a dipole moving in a medium without dispersion is discussed and formulae (4,4) determining the field of the dipole are derived. The Doppler effect for very high velocities is then considered and it is shown that since dispersion always exists in a real medium a complex effect may take place if condition (5,5) is fulfilled, *i.e.* a source of monochromatic light moving uniformly may radiate in a given direction not one but several Doppler frequencies. As in practice velocities approaching that of light cannot be attained an examination is made of the possibility of observing the complex Doppler effect in the case of an atom moving in a rarefied gas with a velocity much lower than c. The required numerical values are calculated for the cases of sodium in sodium vapour and hydrogen in lithium vapour. The radiation spectrum of a dipole moving in a gas is also considered. Finally the radiation from a dipole moving in a refracting medium with a velocity exceeding the velocity of light for that medium is discussed. It is known that an electron moving with such a velocity radiates light in a certain direction (Cherenkov effect) and necessary conditions are established for an analogous effect to take place in the case of a dipole. The basic principles of an optical model for illustrating the method used in this paper are indicated.

621.315.54 **315**

Electrical Resistance of Liquid [alkali] **Metals.**—Krishnan & Bhatia. (*See* 342.)

621.318.32.017.31 : 538.54 **316**

On the Theory of Eddy Currents in Plane Metal Sheets in the Rayleigh Region.—Rüdiger & Schlechtweg. (*See* 353.)

621.319.7 : 621.385.833 **317**

Potential Distributions of Equal Coaxial Cylinders.—R. D. Hill. (*J. sci. Instrum.*, Nov. 1945, Vol. 22, No. 11, pp. 221–222.) From experimental plots of the field between two electrodes end-to-end, using an electrolytic tank, empirical formulae have been derived for the axial potential in terms of the axial distance and the electrode geometrical factors.

621.384.6 **318**

Radiation from a Group of Electrons Moving in a Circular Orbit.—McMillan. (*See* 440.)

621.396.11 : 535.42 **319**

The Theory of Diffraction.—F. B. Pidduck. (*Phys. Rev.*, 1st/15th Sept. 1945, Vol. 68, Nos. 5/6, p. 142.) Brief note on theoretical work to replace the restricted methods based on Kirchhoff's integral. Anticipatory mention of book "Currents in Aerials and High Frequency Networks" by Pidduck (Clarendon Press, Oxford).

621.396.616 **320**

On the Forced Electromagnetic Oscillations in Spherical Resonators.—O. E. H. Rydbeck. (*Ark. Mat. Astr. Fys.*, 14th Nov. 1945, Vol. 32, Part 3, Section A, No. 11, 18 pp. In English.) A detailed mathematical analysis of the response of the space enclosed by two concentric spheres to excitation by means of a current loop (TE waves) and by a dipole current element (TM waves). The case of a simple hollow sphere is included by assigning to the inner sphere the same medium constants as for the dielectric space. Formulae are given for the intensities of the various modes in terms of the material constants of the space and the boundaries and the location of the exciting loop. The effects of a second loop, terminated by a known impedance, are also evaluated, and also the mutual impedance or coupling between the loops. An equivalent network for the mth resonance of the nth mode of a high-Q hollow sphere with two inserted current loops is derived and illustrated.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.165 + 537.591 **321**

Cosmic Rays.—(*Nature, Lond.*, 3rd Nov. 1945, Vol. 156, No. 3966, pp. 543–544.) Summary of discussion at an Anglo-French Conference on Cosmic Rays held at Bristol University during September 1945.

523.165 **322**

Determination of Orbits in the Field of a Magnetic Dipole, with Applications to the Theory of the Diurnal Variation of Cosmic Radiation.—K. G. Malmfors. (*Ark. Mat. Astr. Fys.*, 14th Nov. 1945, Vol. 32, Part 3, Section A, No. 8, 64 pp. In English.) A knowledge of the trajectories of charged particles in the earth's magnetic field is relevant to the theory of the aurora and to certain cosmic radiation problems. The paper describes an experimental investigation of this subject. See also 3471 of 1945. A magnetized Al-Ni-Co steel ball, 10 cm in diameter was used to represent the earth, and an electron gun was mounted in the vicinity of the surface. The whole assembly was so mounted inside a cylindrical brass vacuum chamber that any desired orientation of the beam relative to the sphere could be obtained. A fluorescent screen at one end of the cylindrical chamber was used to determine the deflection of the beam from its original path.

The main conclusion with regard to cosmic radiation is "it would seem improbable that the difference in diurnal variation arises from particles of energy less than 10^{10} eV, and it accordingly follows therefrom, that the magnetic field of the Sun cannot be the cause of this variation. If the working hypothesis of the isotropic distribution of cosmic radiation in space is not exactly fulfilled, it would appear that therein resides one possibility for explaining the effect as observed."

523.72 **323**

Departure of Long-Wave Solar Radiation from Black-Body Intensity.—E. V. Appleton. (*Nature, Lond.*, 3rd Nov. 1945, Vol. 156, No. 3966, pp. 534–535.) Comment on 1028 and 3252 of 1945 ". . . there is evidence . . . which suggests that during periods of marked solar activity the sun occasionally emits radiation in the radio spectrum greatly in excess of black-body radiation corresponding to 6 000°K."

523.746.5 **324**

A Forecast of Solar Activity.—W. Gleissberg. (*Nature, Lond.*, 3rd Nov. 1945, Vol. 156, No. 3966, p. 539.) The next maximum in sunspot activity will probably be the greatest within living memory. It is likely to be reached before May 1948.

LOCATION AND AIDS TO NAVIGATION

621.3 (41) "1939/1945" **325**

British Electrical Engineers and the Second World War.—Dunsheath. (*See* 415.)

621.396 **326**

Radio in the U.S. Navy.—(*See* 417.)

621.396.9 **327**

The Pioneers of Electromagnetic Detection [Radar] **in Great Britain.**—S. Cripps. (*Onde élect.*, Nov. 1945, Vol. 20/25, No. 224, pp. 128–131.) Based on 3909 of 1945.

621.396.9 **328**

Fundamentals of Radar—3. Radar as a Weapon of Offence: ASV and H2S.—(*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 363–365.) A description of the systems for the detection of surface vessels from aircraft (ASV), and for the electronic reproduction of a map of the terrain beneath an aircraft (H2S). First started on a wavelength of 1½ m, these systems were later improved by the use of centimetre wavelengths. The beam shape is such that equal echoes are received from similar targets at any positions within the range of the instruments. Later improvements on H2S introduce a correction for the height of the aircraft and yield an undistorted map instead of a "slant-range" map. For parts 1 and 2 see 3903 of 1945 and 85 of January.

621.396.9 **329**

Radar.—(*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 35–37.) Nine photographs of U.S. Army ground locators SCR 268 and SCR 547 for controlling anti-aircraft guns and searchlights.

621.396.9 **330**

Practical Radar: Part 6.—J. McQuay. (*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 41..99.) Technical details of methods of displaying target information. The special requirements of cathode-ray tubes used in radar are given, and the generation of linear, circular and spiral time bases is described. The indication of echoes by either electrostatic or electromagnetic deflection or by intensity modulation of the beam leads to the display of one coordinate by simple deflection of the linear or circular time base, or two coordinates by the raster method, using intensity modulation. The plan position indicator with synchronized rotating aerial and radial time base is explained. A glossary of radar terms is appended.

621.396.9 **331**

A Radio Navigational Aid.—(*Nature, Lond.*, 3rd Nov. 1945, Vol. 156, No. 3966, p. 542.) A brief description of a device developed by the Decca Navigator Co., involving measurement of phase differences between ground signals received from two or more fixed long-wave transmitters. The accuracy is about 200 yards at 300 miles, and is better for shorter ranges.

621.396.9 **332**

Detection of Birds by Radar.—D. Lack & G. C. Varley. (*Nature, Lond.*, 13th Oct. 1945, Vol. 156, No. 3963, p. 446.) Letter giving evidence of radar echoes from birds (gulls, geese, and starlings) travelling at speeds of about 30 mph which were frequently confused with fast-moving ships. See also 333.

621.396.9 **333**

Detection of Birds by Radar.—H. A. C. McKay. (*Nature, Lond.*, 24th Nov. 1945, Vol. 156, No. 3969, p. 629.) Letter containing quotations from a German document about "spurious echoes" which the present writer attributes to birds. The Germans appear to think the echoes were due to layers in the atmosphere. See also 332.

621.396.9 : 534.321.9 **334**

Acoustic Control in the Flight of Bats.—Hartridge. (*See* 258.)

621.396.9 : 534.88 **335**

Safeguarding our Seaways—The Modern Nautical Chart.—A. L. Shalowitz. (*Sci. Mon., N.Y.*, Oct. 1945, Vol. 61, No. 4, pp. 249–264.) Includes an account of the Radio-Acoustic-Ranging method for determining geographic position when out of sight of land. The sound wave from a bomb exploded under water by the survey ship is received by a hydrophone attached to an anchored sono-radio buoy. This wave causes a radio signal to be transmitted by the buoy for reception at the survey ship, where observation is made of the delay between the explosion and the received signal.

621.396.9 : 629.13 **336**

Timing [high-speed aircraft] **by Radar.**—H. B. D. (*See* 397.)

621.396.931/.933].2 : 621.396.61 **337**

Calibrating Transmitters, Types TV.10, TV.11 and TV.12.—M. D. Tooley. (*Marconi Rev.*, July/Sept. 1945, Vol. 8, No. 78, pp. 89–95.) The low-power portable transmitters are designed for use at d.f. stations, and provide a vertically-polarized signal. In each transmitter type, provision is made for c.w., m.c.w., and keyed operation, with a frequency stability of "not worse than 0.1% after an initial warming-up period". Each type operates from a 6 V car battery, a built-in vibra-pack with a full-wave cold-cathode rectifier is used to provide high-tension supply. Type TV.10 covers the frequency range 5.8–30 Mc/s in four bands; a five-section tubular aerial is used. Type TV.11 covers the band 0.15–1.5 Mc/s in four bands, and is designed to work with an L aerial. Type TV.12 operating in the band 30–80 Mc/s, uses an aerial similar to that used with the TV.10. Full circuit details are given.

MATERIALS AND SUBSIDIARY TECHNIQUES

549.514.1 **338**

Optical Methods for Determining the Orientation of Quartz Crystals.—R. S. Rivlin. (*J. sci. Instrum.*, Nov. 1945, Vol. 22, No. 11, p. 221.) A reflection method for finding the direction of the *a*-axis on a ground surface of quartz parallel to the (0001)-plane by observation of scintillations when the crystal surface is rotated in its own plane. Accuracy is increased by the deposition of a silver film on the surface.

549.514.1 **339**

Quartz Crystals.—In the UDC numbers for abstracts 91, 92 and 126 of January, for 594.514.1 read 549.514.1.

621.3.047.43 (23.03) **340**

Carbon-Brush Contact Films.—R. H. Savage. (*Gen. elect. Rev.*, Oct. 1945, Vol. 48, No. 10, pp. 13–20.) A carbon brush sliding on copper in vacuum shows high friction and rate of wear which is stopped instantly by water vapour at a pressure greater than 3 mm Hg. Solid adjuvants (CdI_2 or $PbCl_2$) in the brush reduce the vapour pressure required to 0.1–0.2 mm Hg. The glazed film of carbon found on copper surfaces is formed at normal humidities and will maintain the low friction condition for a short period at low humidity, *e.g.* in high-altitude flying. Measurements with a blast of water vapour on the collector surface showed that the average water molecule evaporates from a carbon surface in less than 10^{-3} sec, and a calculation supported by tests gives 0.7×10^{-6} sec.

621.315.2 **341**

Some New Features of Low-Voltage Cable.—L. D. Madsen & R. B. McKinley. (*Gen. elect. Rev.*, Oct. 1945, Vol. 48, No. 10, pp. 44–47.) An outline of various types of insulated cables for power distribution, and the advantages of overhead cables over bare wires. Use of polyvinyl chloride and chloroprene on rubber insulation reduces breakdown risks on underground cables. Polyvinyl chloride has been used to protect 11 kV busbars.

621.315.54 **342**

Electrical Resistance of Liquid [Alkali] **Metals.**—K. S. Krishnan & A. B. Bhatia. (*Nature, Lond.*, 27th Oct. 1945, Vol. 156, No. 3965, pp. 503–504.) A theoretical explanation is considered for the observed increase of about 50% which occurs on melting.

621.315.54 : 621.316.849 **343**

Resistivity of Thin Metallic Films.—A. Van Itterbeek & L. De Greve. (*Nature, Lond.*, 24th Nov. 1945, Vol. 156, No. 3969, pp. 634–635.) Measurements at different temperatures on the temperature coefficient of resistance of nickel films between 20 and 700 $m\mu$ in thickness, show a sudden discontinuity at 358°C. Thin films less than 40 $m\mu$ possess a negative temperature coefficient.

621.315.55 **344**

Aluminium Alloys as Conductors.—A. Schulze. (*Arch. tech. Messen*, Oct. 1943, No. 148, T.122.) A condensed account of the properties of alloys containing different proportions of Si, Fe, Ca, and Mg, in relation to their use for overhead transmission lines. The mechanical strength and electrical conductivities for several alloys are given graphically and in tables. The properties of Aldrey are given in detail.

621.315.59 **345**

The Electrical Properties of Semi-Conductors.—R. J. Maurer. (*J. appl. Phys.*, Oct. 1945, Vol. 16, No. 10, pp. 563–570.) Experiments which have yielded information regarding the behaviour of electrons in semi-conductors are reviewed. Evidence based on measurement of electrical conductivity, the Hall effect and thermoelectric effects are discussed, together with data dealing with departures from stoichiometric proportions in the lattice of the substance concerned. "Deviations from stoichiometric proportions are the most important type of 'impurity' which one has to consider when dealing with the electrical properties of semi-conducting compounds. There are available physical-chemical methods by which, in favorable cases, the degree of disorder may be determined as a function of the equilibrium conditions. The combination of these measurements with the determination of the electrical conductivity, σ, and the Hall constant, R, enables one to deduce the mean free path and the density of conducting particles as a function of the degree of disorder and of the temperature."

621.315.59 **346**

The Basic Principles of Semi-Conductors.—F. Seitz. (*J. appl. Phys.*, Oct. 1945, Vol. 16, No. 10, pp. 553–563.) A review of typical deviations from ordinary valence rules by alloys and inorganic compounds, and of the effect on the electrical properties of a compound of a deviation from stoichiometric proportions. The value of information obtained from electrical measurements is illustrated by reference to several semi-conducting compounds.

621.315.612.4 **347**

Dielectric Constants of Some Titanates.—B. Wul. (*Nature, Lond.*, 20th Oct. 1945, Vol. 156, No. 3964, p. 480.) The permittivities of Be, Mg, Ca, Zn, Sr, Cd and Ba titanates, measured at room temperature at 1 Mc/s, ranged from 17 for Mg to greater than 1 000 for Ba. A curve shows the large variation in permittivity of barium titanate with temperature over the range −200 to + 300° C.

621.315.613.1 **348**

Synthetic Mica.—(*Elect. Rev., Lond.*, 7th Dec. 1945, Vol. 137, No. 3550, p. 826.) Notice of two reports (one British, one American) issued by the Mica Trade Association, on German manufacture of synthetic mica and substitute materials.

621.315.616.9+679.5](213) **349**

Properties of Plastics [in Tropical Conditions].—S. Rogerson: W. J. Tucker: P. I. Smith. (*Electronic Engng*, Sept. 1945, Vol. 17, No. 211, p. 698.) Correspondence arising from 3044 and 3359 of 1945.

621.315.616.9 : 536.41 **350**

Thermal Expansion and Second-Order Transition Effects in High Polymers, Part II. Theory.—R. F. Boyer & R. S. Spencer. (*J. appl. Phys.*, Oct. 1945, Vol. 16, No. 10, pp. 594–607.) "The nature of the thermal expansion anomaly in high polymers, known as the second-order transition, is examined in some detail. It is suggested that below the transition temperature, Tm, polymer chains can expand sidewards but not parallel to their length. At Tm lengthwise expansion becomes prominent, thus accounting for the sudden increase in thermal expansion. Experimental results are presented showing the anisotropic expansion of oriented polymers below Tm. The transition effect is then treated as a problem in viscous flow, which gives rise to various semi-empirical plots connecting Tm with applied forces, plasticizer content, and time effects. The brittle point, T_b, involves highly elastic deformation, and is shown to be a fundamentally different test, although Tm and T_b are sometimes numerically equal. Various factors influencing the brittle point are reviewed briefly." For part I, see 3605 of 1944.

621.315.616.9 : 541.64 **351**

Molecular Weight Studies on High Polymers with the Electron Microscope.—R. F. Boyer & R. D. Heidenreich. (*J. appl. Phys.*, Oct. 1945, Vol. 16, No. 10, pp. 621–639.) A technique is described for isolating single polymer molecules, and examining them under the microscope. Circular particles 15–500 A in diameter have been observed, and are believed to represent single molecules. The relation between diameter and molecular weight is reviewed in detail. "The data appear to favor the concept of a random coil to the extent that particle diameter varies as the square root of the molecular weight. The molecular weight distribution curves obtained are of the expected shape and extent, although the average molecular weights computed from the distribution curves are 4–5 times greater than values measured by an independent method. Finally, the role of electrical charges in stabilizing isolated polymer molecules is discussed."

621.315.617.3 **352**

Insulating Varnishes.—(*Elect. Rev., Lond.*, 14th Dec. 1945, Vol. 137, No. 3551, p. 857.) Short report of a discussion by the Radio Section I.E.E., led by C. R. Pye. "Probably the type most likely to come into general use would be based on 'Silicone' polymers . . ."

621.318.32.017.31 : 538.54 **353**

On the Theory of Eddy Currents in Plane Metal Sheets in the Rayleigh Region.—O. Rüdiger & H. Schlechtweg. (*Arch. Elektrotech.*, Jan./Feb. 1944, Vol. 38, Nos. 1/2, pp. 42–56.) Starting from the Rayleigh expression $B = \mu_a H + \frac{\alpha}{2} H^2$ for weak fields, the differential equation for the field distribution in a metal sheet is approximately solved. The current density and eddy-current loss are then determined. The loss is separable into two parts, one corresponding to permeability independent of field strength, and the other proportional to α. Functions required for practical application are given in graphs. Numerical examples are worked out. The loss proportional to α can, in some cases, be only a small fraction of the total, but it can be substantial for silicon alloys, and for those of the Permalloy type.

621.318.322 : 538.27 **354**

Increase of Initial Permeability due to Elastic Stress.—K. Sixtus. (*Naturwissenschaften*, Feb./March, 1944, Vol. 32, Nos. 5/13, pp. 73–74.) A brief report of experiments showing the effect of slight bending on the permeability of Fe–Si (3% Si) stampings. For alternating fields of the order of 0.01 Oersted the permeability was increased by factors up to 1.5. For strong fields the permeability was slightly reduced.

621.385.832 + 535.37 **355**
On the Question of the Upper Temperature Limit of the Luminescence of Phosphors.—Brauer. (*See* 447.)

621.52 **356**
High-Vacuum Pumps. — R. Witty. (*J. sci. Instrum.*, Nov. 1945, Vol. 22, No. 11, pp. 201–206.) A description of two types of rotary oil pump, and the principles of operation of diffusion pumps, with an outline of the construction of some modern types.

621.52 **357**
Use of Silicones as Diffusion Pump Oils.—G. P. Brown. (*Rev. sci. Instrum.*, Nov. 1945, Vol. 16, No. 11, pp. 316–318.) Two silicones, a straight hydrocarbon (Litton C), an ester (Octoil) and a chlorinated aromatic hydrocarbon (Narcoil) were compared for performance in a nonfractionating diffusion pump. The high-boiling silicone produces the highest vacuum, as indicated by an untrapped ionization gauge, and is almost completely free from oxidation when exposed to air while hot. A table showing the relative merits of the oils is given.

621.791.3 **358**
Self-Soldering.—(*Wireless World*, Dec. 1945, Vol. 51, No. 12, p. 387.) A short note on a device for soldering telephone cables in the field. A small copper tube contains cored solder, and has a combustible material on the outer surface. The ends of the wire are twisted and inserted in the tube, and the outer material is ignited by striking on the packing box as if it were a match.

679.5 **359**
Modern Plastics [Book Review].—H. Barron. Chapman & Hall, London, 1945, 680 pp., 42s. (*Engineering, Lond.*, 19th Oct. 1945, Vol. 160, No. 4162, p. 303 ; *Beama J.*, Oct. 1945, Vol. 52, No. 10, pp. 338–339.) A text-book for the general scientific or technical reader, rather than for the specialist.

MATHEMATICS

517.942.9 **360**
The Laplace Equation.—E. Kasner & J. De Cicco. (*Science*, 7th Sept. 1945, Vol. 102, No. 2645, pp. 256–257.) Letter on some difficulties involved in transformation of the three-dimensional equation.

518.5 **361**
A New Type of Differential Analyzer.—V. Bush & S. H. Caldwell. (*J. Franklin Inst.*, Oct. 1945, Vol. 240, No. 4, pp. 255–326.) The instrument incorporates features of proven merit from earlier designs, but has greater precision, scope and flexibility. It can be used by investigators working either locally or at a distance.

531.314 : 621.385 **362**
Dynamics of Electron Beams.—D. Gabor. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 792–805.) Hamiltonian dynamics are presented in their two less familiar forms, *viz.*, the canonical equations expressing the energy of motion of a particle in terms of its position and momentum, and the Hamilton-Jacobi equation, expressing motion in terms of an action function when the momentum is irrotational. This covers all cases of electron motion in electrostatic fields, and in electromagnetic fields having no component normal to the cathode. The equations can be applied to the motion not only of a single electron but also to that of a regular stream of electrons.

The method can be used for graphical and numerical approximate solutions of electron motion, or for the inverse problem of designing the field to produce a certain desired type of motion. The Hamilton-Jacobi equation also lends itself to the treatment of small perturbations caused by changes in the electromagnetic field.

Transit-time effects are dealt with by transforming the equation into one symmetrical in time and space coordinates, and this is shown to be equivalent to the principle involved in phase-focusing. The case of electrons with random motion is dealt with by introduction of Hamilton's phase-space and inclusion of a density distribution term in the canonical equations.

These methods provide useful tools for determining solutions of the more general problems, and for developing solutions for special cases of the more complex problems of electron beams.

621.385 **363**
Space Charge between Coaxial Cylinders.—Page & Adams. (*See* 485.)

MEASUREMENTS AND TEST GEAR

621.3.012.3 : 621.3.017.21 **364**
Loss due to Series Resistance between Matched Source and Sink.—(*Radio*, Oct. 1945, Vol. 29, No. 10, p. 38.) Chart with explanatory diagram.

621.317.32 **365**
Sphere-Gaps : Irradiation and Impulse-Voltage Measurement.—J. M. Meek. (*Elect. Rev., Lond.*, 30th Nov. 1945, Vol. 137, No. 3549, p. 778.) Short account of a paper and discussion at the I.E.E. An investigation has shown the need for some revision of the B.S. rules for measurement with sphere-gaps. Irradiation (*e.g.* by insertion of radium in the high-voltage sphere) is necessary to avoid errors in the measurement of impulse voltages.

621.317.33 : 621.396.662.2 **366**
Simplified Coil Testing.—G. T. Clack. (*Electronic Engng*, Dec. 1945, Vol. 17, No. 214, pp. 829–832.) Simple circuits are given for testing resistance, insulation, and inductance, involving only a milliammeter and valve voltmeter as measuring instruments. The latter should be of good stability with an operating range up to 20 Mc/s. Inductance methods given include direct measurement at l.f., comparator bridge, oscillator and valve-voltmeter, and dynatron. For production testing, comparison with a standard coil frequently offers the most convenient method.

621.317.332 : 621.315.14 **367**
A Method of Measuring the Radiofrequency Resistance of Wires.—C. Stewart, Jr. (*J. appl. Phys.*, Oct. 1945, Vol. 16, No. 10, pp. 608–614.) A coaxial transmission line 10–100 ft long, with the wire under test as the inner conductor and a metal tube as the sheath, is short-circuited at one end and connected at the other to a commercial Q-meter.

Conditions are chosen so that the line impedance is inductive at the test frequency, and so that errors introduced by the Q-meter internal resistance are minimized. The theory of the method, which is suitable for use in the frequency range 0.2 to 40 Mc/s, is given in detail. The technique " appears to be more reliable than the use of coils, assuming all precautions just described to be taken and considering commercial test equipment commercially available at present. Also the results of this method agree closely with those of calculations by skin effect formulas."

621.317.35 **368**

The Short - Time - Constant Circuit.—M. G. Scroggie. (*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 358–361.) The application of a square-wave signal to an R-C circuit with a short time constant is investigated by Fourier analysis, the waveform of the voltage across the resistor being derived, and compared with experimental observation. A demonstration of the principle of wave analysis.

621.317.361 **369**

Frequency Measuring System.—H. O. Peterson. (*Radio*, Oct. 1945, Vol. 29, No. 10, p. 40.) A system for combining harmonics and sub-harmonics of a crystal oscillator to produce a wide range of controlled frequencies by decade switching. Summary of U.S. Patent No. 2 380 868.

621.317.361 : 621.396.615.17 **370**

Automatic Control for Locked Oscillator.—McCool. (*See* 474.)

621.317.39.082.7 **371**

An Electrical Moisture Meter.—Hartshorn & Wilson. (*See* 388.)

621.317.42.089.6 **372**

Note on Calibration of Grassot Fluxmeters.—R. S. J. Spilsbury & C. E. Webb. (*J. sci. Instrum.*, Nov. 1945, Vol. 22, No. 11, pp. 213–215.) " Small discrepancies in the calibration of fluxmeters were traced to differences in the time interval between break and make of the reversing switches employed. Similar variations in the deflexion produced by a given change of linkage were found to occur when the rate of fall of the coil in a Hibbert Magnetic Standard was altered, and it is concluded that the effect depends on the velocity attained by the moving coil of the fluxmeter and hence implies variability in the damping coefficient. The avoidance of errors arising from this effect, by the choice of a suitable calibration procedure, is important if the fluxmeter is to be used for measurements of high precision."

621.317.715 **373**

A Galvanometer Amplifying System of Great Sensitivity.—D. C. Gall. (*J. sci. Instrum.*, Nov. 1945, Vol. 22, No. 11, pp. 218–219.) " A double . . . system using a photocell and thyratron . . . The sensitivity of the galvanometer is increased by positive mechanical feed-back and the circuit stabilized by negative electrical feed-back. It enables fractions of a microvolt to be recorded."

621.317.723 **374**

Measurement of High Voltages.—J. M. Meek & F. W. Waterton. (*Nature, Lond.*, 6th Oct. 1945, Vol. 156, No. 3962, pp. 422–423.) An attracted-disk electrometer for absolute measurement of a.c. or d.c. voltages up to 100 kV with an accuracy of 0.3% is operated in a continuously-evacuated system to avoid breakdown, convection currents, and effects of dust and humidity.

621.317.725 + 621.317.734] : 621.385 **375**

Electronic Volt-Ohmmeter.—H. H. Arnold. (*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 48..132.) A sensitive valve voltmeter using a large-scale meter of low sensitivity. The circuit is of an unbalanced bridge type, two valves in adjacent arms acting as a phase inverter to give a linear scale. Use of a cathode-follower stage gives input impedance 30–300 MΩ. The ohmmeter section employs a voltage-dividing network. Ranges 0–6 000 V in six ranges beginning 0–6 V, and $0.1–5.10^8$ Ω.

621.317.726 : 621.385 **376**

A High Impedance Pulse Voltmeter.—D. E. Howes. (*Rev. sci. Instrum.*, Nov. 1945, Vol. 16, No. 11, p. 322.) A cathode-coupled amplifier is connected to a conventional diode rectifier, using a single 6SN7 (double triode) for the two purposes. The advantages are a high input impedance with a comparatively low output impedance. The instrument responds equally well to pulses from one to 20 μs in length.

621.317.726 : 621.385 **377**

A Voltmeter for Complex Waveforms.—C. H. Banthorpe. (*J. Televis. Soc.*, Dec. 1944, Vol. 4, No. 4, pp. 90–91.) For waves of amplitudes up to 200 V peak-to-peak. The voltage to be measured is applied through a cathode-coupled amplifier to a cathode-ray tube, on which the measurement is made.

The circuit gives a flat response for frequencies up to about 2.5 Mc/s.

621.317.73 **378**

Impedance Bridge with a 10^9 to 1 Range.—(*Nature, Lond.*, 24th Nov. 1945, Vol. 156, No. 3969, pp. 639–640.) Summary of 2285 of 1945. (H. T. Wilhelm.)

621.317.733 + 536.531].087.6 **379**

An Automatic Recorder for Resistance Thermometry.—D. R. Stull. (*Rev. sci. Instrum.*, Nov. 1945, Vol. 16, No. 11, pp. 318–321.) Measurement of temperature to ± 0.01° C with a platinum resistance thermometer requires resistance measurement to ± 0.001 Ω. A standard 10 inch chart recorder will cover a range of 1 Ω, or 10°C, with this accuracy. The Wheatstone bridge including the thermometer is balanced automatically by a 1 Ω slider, the arm of which carries the recording pen. At the ends of its travel an additional 1 Ω from a decade bank is automatically switched in or out as required. The selector switch on the 1 Ω bank of coils at the ends of its travel operates similarly, by a Geneva gear mechanism, the selector switch of a decade bank of 10 Ω resistance coils. A second pen records the positions of the decade resistance selector switches. The range covered is from -190° C to 550° C.

621.317.738 + 621.317.79 **380**

New Types of Test Gear for Television Production.—P. D. Saw. (*J. Televis. Soc.*, Dec. 1944, Vol. 4, No. 4, pp. 76–81.) A description of a reactance comparator and alignment oscillator designed for unskilled operators. The comparator contains an oscillator loosely coupled to a tuned circuit. The resonance frequency of the tuned circuit is varied rapidly about its mean value in synchronism with the movement of a pointer over a scale. The p.d. developed across the circuit when it is in tune with the oscillator operates stroboscopic illumination of the pointer and scale. The pointer appears to be at rest in a position depending on the difference between the oscillator frequency and the mean frequency of the resonant circuit. The components to be tested can be connected to either the oscillator circuit or to the coupled tuned circuit, and components with the same reactance cause the pointer to appear at rest in the same position. For an oscillator frequency of 500 kc/s reactance differences of 0.1 $\mu\mu$F can be observed.

The alignment oscillator generates a signal with mean frequency adjustable from 35 to 50 Mc/s, frequency modulated at 50 c/s over a range of a few Mc/s. There is a buffer output stage. A stable frequency-calibrating oscillator is also provided.

621.317.79 : 621.385 **381**

Vacuum Tube Analyzer.—L. G. Sands. (*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 38..85.) An instrument for checking valve characteristics. Tests on emission, gas current, noise, and transconductance can be made, the latter by using an oscillator to drive the test valve, with a null method of measurement. Voltage supplies for all electrodes are incorporated and are fully variable. Constructional details are included.

621.396.67 : 621.317.33 **382**

Aerial Impedance Measurements. — Essen & Oliver. (*See* 288.)

621.396.67.082 **383**

Technic of Antenna Gain Measurements.—Glinski. (*See* 287.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.714.7 : 621.317.39 **384**

An Electrical Micrometer.—D. C. Gall. (*J. sci. Instrum.*, Nov. 1945, Vol. 22, No. 11, p. 219.) A method of measuring very small displacements by the use of electrical resistance strain gauges attached to a micrometer head. By means of an amplifier, an ink record of the displacement can be made. Full-scale galvanometer deflexion for 0.001 inch.

544.62 : 621.383.8 **385**

An Application of Multiplier Photo-Tubes to the Spectrochemical Analysis of a Magnesium Alloy.—G. A. Nahstoll & F. R. Bryan. (*J. opt. Soc. Amer.*, Oct. 1945, Vol. 35, No. 10, pp. 646–650.)

578.088.7 : 621.314.3 **386**

Biological Amplifiers.—Parnum. (*See* 296.)

621.315.1[/.5] : 621.317.3.082.78 **387**

A Splice Detector for Army Field Wire.—F. S. Hird. (*Bell Lab. Rec.*, Nov. 1945, Vol. 23, No. 11, pp. 424–426.) Another account of 140 of January.

621.317.39.082.7 **388**

An Electrical Moisture Meter.—L. Hartshorn & W. Wilson. (*J. Instn elect. Engrs*, Part II, Oct. 1945, Vol. 92, No. 29, pp. 403–412. Discussion pp. 412–415.) For use with grains, seeds, fabrics, etc. An alternating voltage is applied to the material in a suitably-designed " cell". The current passing through the cell is measured by means of a sensitive thermionic ammeter of special construction, which can be adjusted to read the capacitance current, proportional to the dielectric constant of the material, the conductance current, proportional to its a.c. conductivity, or some function of both these currents chosen to give the most favourable variation with moisture content.

621.318.57 + 621.3.083.7 **389**

Electronic Mechanism for Measurement and Control in Plant and Industry.—T. A. Cohen. (*Instruments*, April 1945, p. 228.) A light disk attached to the pointer of a measuring instrument moves near coils in the grid circuit of an oscillator, causing large changes of anode current. Abstract in *Electronic Engng*, Dec. 1945, Vol. 17, No. 214, p. 836.

621.365 : 621.383 **390**

An Automatic Furnace Discharge Indicator.—(*Beama J.*, Oct. 1945, Vol. 52, No. 10, p. 331.) In a roller hearth electric furnace the moving charge interrupts a light beam and a photoelectric relay mechanism gives warning that the charge is ready to be removed from the furnace.

621.365.5 + 621.365.92 **391**

Radio Heating in Industry.—(*S. Afr. Engng*, Dec. 1945, Vol. 56, No. 12, pp. 284–285.) Elementary account, with reference to an exhibition of equipment dealt with in 4158 of 1945.

621.365.52 : 534.321.9 : 669 **392**

Degassing of Metal Alloys.—W. Esmarch, T. Rommel & K. Benther. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 166, 170.) Summary of a German paper. See also 2048 of 1945, and *Electronic Engng*, July 1945, Vol. 17, No. 209.

621.365.92 : 664.84 **393**

The Electronic Blanching of Vegetables.—J. C. Moyer & E. Stotz. (*Science*, 20th July 1945, Vol. 102, No. 2638, pp. 68–69.) The process gives only 3% loss of ascorbic acid compared with 30–40% for steam or boiling-water blanching. Vegetables in retail cartons are passed between electrodes from a 750 W 150 Mc/s oscillator.

621.365.92 : 679.5.023 **394**

H. F. Heating in Heatronic Moulding.—A. E. L. Jervis. (*Electronic Engng*, Dec. 1945, Vol. 17, No. 214, pp. 819–824.) H.f. heating has advantages for the softening of thermo-setting plastics for moulding. The more uniform heating gives better quality with fewer rejects, there is the possibility of producing more complicated shapes, and the cost is lower. These factors are considered in some detail.

621.385.833 **395**

The Preparation of Specimens for the Electron Microscope.—D. G. Drummond. (*Electronic Engng*, Dec. 1945, Vol. 17, No. 214, pp. 807–809.)

621.396.91 **396**

Flight Similitude Tests of Radiosondes.—National Bureau of Standards. (*J. Franklin Inst.*, Oct. 1945, Vol. 240, No. 4, p. 335.) Samples of mass-produced radiosondes are tested in a chamber in which the ambient pressure and temperature and the ventilation can be made to simulate flight conditions. A short note.

629.13 : 621.396.9 **397**

Timing [high-speed aircraft] **by Radar.**—H. B. D. (*Wireless World*, Dec. 1945, Vol. 51, No. 12, p. 376.) The aircraft flies towards the radar installation and the limits of the course over which its speed is measured are marked by signals generated inside the equipment to simulate echoes from the beginning and end of the course. The coincidence of these signals with echoes from the aircraft mark the beginning and end of the timing operation, which is carried out by counting the pulses emitted by the radar transmitter during the interval, the pulse repetition frequency being known.

629.135 : 621.38 **398**

Electronics at the R.A.E. [Royal Aircraft Establishment] **Exhibition.**—(*Electronic Engng*, Dec. 1945, Vol. 17, No. 214, pp. 810–813.) Measurements of vibration frequencies and amplitudes, accelerations, and static and dynamic strains in structures are among the aircraft constructors' problems that are best solved by electronic means. The pick-up unit is of first importance. Strains are measured by wire resistance gauges; vibrations by a piezoelectric crystal, an electro-magnetic generator, an eddy-current pick-up, or a variable inductance. Capacitors are used to determine torsional vibrations or pressure. Cathode ray tubes or recorders present the information given by the pick-up. The exhibits included items developed by aircraft and instrument firms, by the R.A.E. and by other Ministry of Aircraft Production experimental establishments.

PROPAGATION OF WAVES

621.396.11 + 535.3 **399**

An Exact Theoretical Treatment of Reflection-Reducing Optical Coatings.—Mooney. (*See* 313.)

621.396.11 **400**

Graphical Determination of the Horizon.—W. H. Anderson. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 35..64.) Estimation of optical range over land by drawing the profile of the transmission path with suitably adjusted scales for the radius of the earth and height above sea level.

621.396.11 : 535.42 **401**

The Theory of Diffraction.—Pidduck. (*See* 319.)

621.396.11.029.64 + 621.396.24 + 621.385.1 **402**

Simultaneous Use of Two New Radiocommunication Techniques: Centimetre Waves and Frequency Modulation.—A.-G. Clavier & V. Altovsky. (*Bull. Soc. franç. Élect.*, March 1944, Vol. 4, No. 35, pp. 85–97.) By taking advantage of the special features of centimetre waves (sharp directivity, wide-range modulation), the company " Le Matériel Téléphonique " have been able to realize a multichannel radio-telephony system which " can be inserted in a long-distance telephony traffic system without infringing national standards " (a " hertzian cable "). This result has been obtained by using frequency modulation, negative feed-back, and frequency compression. The authors consider that this terminal technique is now so satisfactory that the use of such centimetre-wave systems will in future be limited only by propagation characteristics.

Experiments carried out in 1941 are described, in which these propagation characteristics were " for the first time " confirmed by observation.

In experiments on sources, the L.M.T. had, in 1939, developed a wave-guide magnetron giving a few milliwatts at a wavelength of 9 mm, but for the long-distance communication experiments a 10 cm velocity-modulation tube was used, giving about 3 W useful output from a horn radiator. A similar tube giving 100 W was developed in 1940–1941, and another giving 25 W at 5 cm wavelength was developed in 1942.

The sender was located at a point on the coast about 700 m above sea level, giving a horizon of about 100 km. The receiver, using a similar horn, was in a specially constructed cabin on board a boat. Up to the horizon, the field strength was inversely proportional to the distance, and at this limit was some 30–35 db above the level needed by the limiter stage of the f.m. receiver. (A recorder in front of the limiter stage gave a measure of relative field strength.) During this first voyage the weather was fine and warm, and the sea calm, as it had been for some time. Beyond the line of sight, the recorder showed pronounced, though not rapid, fluctuations of field strength, with maxima reaching nearly to the line-of-sight level, and minima approaching, but not passing, the minimum level required by the limiter. These fluctuations did not affect the received modulation (speech, music, and pure tone), as frequency modulation was being used—an important practical consideration. This behaviour continued to about 190 km from the sender (90 km beyond the horizon), when the prearranged programme terminated before the limiting distance had been reached.

In some later voyages over the same route, but in bad weather, there was a rapid and fairly uniform fall of field strength beyond the horizon, with loss of contact at about 170 km. In one case both types of variation were observed at different periods.

It is concluded that although a horizontal stratification of optical characteristics may give abnormally long ranges under certain weather conditions, the range of reliable communication on centimetre wavelengths is the horizon of the sender.

621.396.11.029.64 : 551.51.052 **403**

On the Effect of Refraction in the Troposphere on the Propagation of Ultra-Short Radio Waves in a Diffraction Zone.—B. A. Vvedenski (Wwedensky). (*Bull. Acad. Sci. U.R.S.S.*, Sér. phys., 1942, Vol. 6, Nos. 1/2, pp. 41–55. In Russian.) Refraction and diffraction affect the propagation of radio waves of all wavelengths, but the relative importance of each of the two factors varies with the wavelength, and in the case of ultra-short waves refraction becomes predominantly important. A detailed mathematical investigation is presented in which both diffraction and refraction are taken into account, and a formula (6,1) is derived for determining the field due to a vertical elementary dipole radiating ultra-short waves, *i.e.* the case of vertical polarization only is considered, although with minor mathematical adjustments the case of horizontal polarization could also be covered. In order to simplify the necessary calculations, curves published in a previous work by the author, dealing with the purely diffraction problem, could be used.

The following two main conclusions are reached: (a) owing to the presence of refraction the vertical component of the field beyond the horizon may be either smaller or greater than if refraction were absent. This contradicts the commonly accepted notion, due to the indiscriminate introduction of optico-geometrical conceptions into the diffraction formula, that refraction always increases the field component, (b) fading undoubtedly occurs. See also 394 of 1945.

621.396.8.029.63/.64 **404**

Microwave Transmission Power Requirements.—Browder & Young. (*See* 482.)

RECEPTION

621.396.61.029.58 **405**

Engineering British B48 Walkie Talkies.—(*See* 467.)

621.396.61/.62].029.62 **406**

Converting 112-Mc Gear for 144.—Rand : Bradley. (*See* 469.)

621.396.62 **407**

A 21-Tube All-Purpose Receiver.—J. Marshall. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 31–37, 114.) A detailed description of a receiver intended to be equally suitable for high-selectivity long-range communication and for high-fidelity reproduction of broadcast transmission, with provision for phonograph, microphone, and recording facilities.

621.396.621.53 **408**

Conversion Diagrams for Triode Tube Mixers.—H. Stockman. (*J. appl. Phys.*, Oct. 1945, Vol. 16, No. 10, pp. 639–642.) Measurements are described using a grounded-grid acorn valve operated in the grounded-grid condition, the signal and heterodyning voltages being derived from low-impedance sources. I.f. output is measured with a specially designed voltmeter, with a tuned circuit at the input terminals. Ten such circuits are provided, which together cover a wide impedance range ; any one of these input circuits may be selected by a suitable switching operation. It is thus possible to determine the optimum mixer bias and load impedance necessary to give maximum power output at i.f. The i.f. used is 450 kc/s and examples of experimental results for a signal frequency of 7 Mc/s are included. Noise considerations are excluded from discussion. " It is understood that the . . . diagrams and curves [given] do not completely describe the operation of a triode tube mixer but merely serve to indicate how the operation may be studied . . ." For previous work see 1522 of 1944 and 778 and 2600 of 1945.

621.396.621.53.029.62 **409**

Home Constructed 112 Mc Receiver.—J. Gavin & S. Heytow. (*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 29..129.) A superheterodyne receiver using conventional circuits and valves. Constructional details of the 15 Mc/s i.f. transformers are given.

621.396.621.53.029.62 **410**

112 Mc. Converter.—R. Frank. (*Radio News*, Nov. 1945, Vol. 35, No. 5, pp. 46..78.) Design and constructional details of a unit including a twin triode as local oscillator and mixer to give an i.f. of 20 Mc/s. This is connected to a suitable communications receiver.

621.396.621.53.029.62 **411**

A Four-Tube Superheterodyne for 144 Mc.—B. Goodman. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 27–30, 108.) A super-regenerative second detector is used. This combination is claimed to be free from some of the disadvantages of the straight super-regenerative circuit, *e.g.* lack of selectivity and undesired antenna reaction, and receiver radiation. Constructional details are given.

621.396.645.33 **412**

Audio Section Design Data for Battery Operated Receivers.—Sylvania Electric Products, Inc., Engineering Dept. (*See* 279.)

621.397.62 **413**

Extended-Range Television Reception : Part I.—Wilder. (*See* 463.)

621.396/.397].62 **414**

Radio Receiver Design, Part II [Book Review].—K. R. Sturley. Chapman & Hall, London, 480 pp., 28s. (*Wireless Engr*, Dec. 1945, Vol. 22, No. 267, p. 586.) An inadequate chapter on television " mars an otherwise excellent book ". For reviews of Part I see 2893 of 1944.

STATIONS AND COMMUNICATION SYSTEMS

621.3(41) " 1939/1945 " **415**

British Electrical Engineers and the Second World War—P. Dunsheath. (*Engineer, Lond.*, 12th & 19th Oct. 1945, Vol. 180, Nos. 4683 & 4684, pp. 280–281 & 302–305.) Long summary of I.E.E. Presidential address, containing a brief account of the war activities of the Post Office, *e.g.* jamming of German army radio communications ; reception and re-radiation of German air navigation signals to mislead hostile aircraft ; crystal control of groups of broadcasting stations on identical frequencies to prevent their use for air navigation ; great expansion of emergency home communication routes, particularly the 1 + 3 system (one audio and three carrier-frequency channels). The main developments of radar are also described.

621.391.1 **416**

Multichannel Communication Systems.—F. F. Roberts & J. C. Simmonds. (*Wireless Engr*, Dec. 1945, Vol. 22, No. 267, pp. 576–580.) Part II of a paper dealt with in 183 of January. Detailed descriptions are given of the oscillator, phase divider, pulse generator and modulator units of the transmitter, and the synchronizing and demodulating units of the receiver. Results obtained with the experimental apparatus are given. Cross-talk was 42 db between adjacent channels and 45 db to other channels ; on speech, cross-talk was audible but unintelligible, and with a large number of channels could be classed as noise. The effective audio band was 200–3 500 c/s.

621.396 **417**

Radio in the U.S. Navy.—(*QST*, Oct. 1945, Vol. 29, No. 10, pp. 14–64.) Four articles by members of the U.S. Navy describing Naval radio communications in all its branches, and Radar, with numerous photographs of air-borne and sea-borne equipment, training stations, etc.

621.396.24 + 621.396.11.029.64 + 621.385.1 **418**

Simultaneous Use of Two New Radiocommunication Techniques : Centimetre Waves and Frequency Modulation.—Clavier & Altovsky. (*See* 402.)

621.396.61 **419**

War Reporting Equipment used by the B.B.C.—Richardson & Walker. (*See* 466.)

621.396.61.029.64 **420**

Army Set No. 10.—(*See* 470.)

621.396.619 **421**

Pulse-Width Modulation.—(*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 361–362.) Description of the basic principles. Good reproduction can be achieved using only two pulses per cycle of the highest modulation frequency transmitted. Several channels may be superimposed on a single carrier by inserting the pulses of one channel in the intervals of the remaining channels.

621.396.641.1/.2 **422**

The Outlook for Radio Relaying.—R. Bown. (*Bell Lab. Rec.*, Oct. 1945, Vol. 23, No. 10, pp. 365–367.) Wire telephony has, in the past, been of higher quality than radio telephony due to the advantages of directivity, available frequency spectrum, and relative freedom from noise and transmission disturbances. In these respects microwave radio is comparable with wired circuits, and it seems possible that microwave telephony links can have quality comparable with wire telephony.

621.396.8.029.63/.64 **423**

Microwave Transmission Power Requirements.—Browder & Young. (*See* 482.)

621.396.97.029.62 **424**

U.H.F. and Post-War Broadcasting.—K. I. Jones & D. A. Bell. (*J. Televis. Soc.*, Mar. 1944, Vol. 4, No. 1, pp. 6–9.) Opening contribution to an I.E.E. discussion, 2344 of 1944.

SUBSIDIARY APPARATUS

518.5 **425**

A New Type of Differential Analyzer.—Bush & Caldwell. (*See* 361.)

620.193(213) : 621.396.6 **426**

Tropic-Proof Components : A Reader's Experience [in Malaya].—R. C. Joyce. (*Electronic Engng*, Sept. 1945, Vol. 17, No. 211, p. 698.)

621.315.2 : 621.317.333.4 **427**

A Simple Method of Locating Insulating Faults Affecting All Conductors in a Cable.—H. Weber. (*Tech. Mitt. schweiz. Telegr. Teleph. Verw.*, 1st April 1945, Vol. 23, No. 2, pp. 51–55. In both French and German.)

621.315.2 : 621.317.333.4 **428**

On the Location of Insulation Faults in Cables.—C. Lancoud. (*Tech. Mitt. schweiz. Telegr. Teleph. Verw.*, 1st April 1945, Vol. 23, No. 2, pp. 56–74. In both French and German.)

621.315.2 : 621.317.79 **429**

The Lookator.—J. T. Schott. (*Bell Lab. Rec.*, Oct. 1945, Vol. 23, No. 10, pp. 379–383.) A device using pulse technique to locate faults in transmission lines. Pulses are applied to the line and the fault, being a discontinuity, gives reflected pulses which are displayed on a c.r. tube. The distance of the fault is derived from the time delay of the reflected pulse, and the form of the trace often gives good indication of the type of fault.

621.315.212.1 : 621.316.54 **430**

A Simple Coaxial Switch.—Burgess. (*See* 283.)

621.315.221 : 620.193.7 **431**

Study of A.C. Sheath Currents and their Effect on Lead-Cable-Sheath Corrosion.—Sherer & Granbois. (*See* 511.)

621.315.221 : 620.193.7 **432**

Electrolysis and Corrosion of Underground Power-System Cables.—Gorman. (*See* 510.)

621.316.849 : 621.315.54 **433**

Resistivity of Thin Metallic Films.—Van Itterbeek & De Greve. (*See* 343.)

621.317.733 + 536.531].087.6 **434**

An Automatic Recorder for Resistance Thermometry.—Stull. (*See* 379.)

621.318.42 **435**

The Design of H. F. Chokes.—V. J. Cooper. (*Marconi Rev.*, July/Sept. 1945, Vol. 8, No. 78, pp. 105–112.) An account of the design of simple single-layer unscreened solenoid chokes based on an examination of the characteristics of a large number of them. Curves are given which enable the lowest order anti-resonant and resonant frequencies to be derived from the choke dimensions and length of wire used. Wavelength range considered, 6–300 m.

621.319.7 : 621.385.833 **436**

Potential Distributions of Equal Coaxial Cylinders.—Hill. (*See* 317.)

621.383.2 **437**

The Colour Response of [emissive] **Photoelectric Cells.**—A. Sommer. (*J. Televis. Soc.*, Sept. 1944, Vol. 4, No. 3, pp. 51–57.) Simple theory and properties of emission photo-electric cells. Einstein's equation for the conversion of energy of radiation into electronic energy gives the relation $V = 12\,336/\lambda$, where V is the velocity of an emitted electron in electron-volts, and λ is the wavelength of the incident light in Angstrom units.

The conditions for high photo-electric emission are capacity for absorption of light, availability of loosely bound electrons, low work function, and the substance must be neither a good insulator nor a good conductor. The manufacture of the silver-oxygen-caesium cell and of the antimony-caesium cell are described, and their spectral responses explained.

The choice of cells for particular light sources is discussed. The normal practice of defining sensitivity in terms of response to lumens of incident light is shown to be faulty : it is better to match the spectral emission curve of the light source to the performance curves of the available photo-cells. Examples are given of correct matches, using the performance curves of cells in common use.

621.384.6 **438**

A 100-Million Volt Induction Electron Accelerator.—W. F. Westendorp & E. E. Charlton. (*J. appl. Phys.*, Oct. 1945, Vol. 16, No. 10, pp. 581–593.) " The plan and construction of a device capable of accelerating electrons to energies as high as 100 million electron volts are described together with the special building to house it. A more detailed description of the device and its construction will appear in the *General Electric Review*. The accelerator has a pole face 76 inches in diameter, weighs 130 tons, and operates on 60-cycle current requiring at full load 200 kilowatts. The machine is air cooled and is capable of continuous operation at full voltage . . ." Loading difficulties introduced by small variations in the supply frequency are described, together with the method evolved of avoiding such troubles. Measurements made on the output of X-rays under continuous and pulsed operation are detailed.

621.384.6 **439**

The Synchrotron – A Proposed High Energy Particle Accelerator.—E. M. McMillan. (*Phys. Rev.*, 1st/15th Sept. 1945, Vol. 68, Nos. 5/6, pp. 143–144.) A device related to the cyclotron offering the possibility of reaching energy in the 10^9eV range with either electrons or heavy particles.

621.384.6 **440**

Radiation from a Group of Electrons Moving in a Circular Orbit.—E. M. McMillan. (*Phys. Rev.*, 1st/15th Sept. 1945, Vol. 68, Nos. 5/6, pp. 144–145.) When a concentrated group of electrons moves in a circular orbit the radiation loss will not seriously affect the operation of the " synchrotron ".

621.396.611 **441**

Air-Seal Test Set for [Quartz] **Crystal Units.**—G. W. Willard. (*Bell Lab. Rec.*, Oct. 1945, Vol. 23, No. 10, pp. 361–364.) Quartz crystal plate holders for use in arctic or tropical conditions must be sealed, and a routine test is necessary to detect air holes in the seal. The holders are placed in a chamber that is exhausted for a specified period. A high voltage is then applied to the terminals of the crystals and the value of the ionization current, which depends on the pressure within the holder, indicates whether leakage has taken place.

621.396.662.2 : 621.317.33 **442**

Simplified Coil Testing.—Clack. (*See* 366.)

621.319.45 **443**

The Electrolytic Capacitor [Book Review].—A. M. Georgiev. Murray Hill Books, New York, 191 pp., $3.00. (*Radio News*, Nov. 1945, Vol. 34, No. 5, p. 62.) " . . . a comprehensive study of the design, construction, manufacture, function, and testing . . ." For another review see 4005 of 1945.

TELEVISION AND PHOTOTELEGRAPHY

621.317.738 + 621.317.79 **444**

New Types of Test Gear for Television Production.—Saw. (*See* 380.)

621.383 : 621.397.611 **445**

The Isoscope : A Slow-Electron Image Analyser.—R. Barthélemy. (*Onde élect.*, Nov. 1945, Vols. 20/25, No. 224, pp. 103–115.) The author calls attention to the drawbacks of the Iconoscope—particularly those due to unwanted secondary emission. " It is interesting to note how unlikely it was, in view of this emission, that this device would ever be satisfactory." He then gives a fairly long account of the Orthiconoscope (Radio Corporation) in which the desired minimization of secondary emission was sought by using a slow-speed electron beam, with electric deflexion, magnetic focusing and an axial direction. This necessitated a transparent mosaic and various other modifications of the original Iconoscope assembly. It has its own drawbacks, which are enumerated, but " the balance is nevertheless very favourable to the use of slow-speed electrons ".

In view of the difficulty of getting uniform intensity over the whole mosaic with electric deflexion, the author has studied the possibility of magnetic deflexion, and, in conjunction with Paumier, Monnot and Bobenrieth, has developed a new tube of this type giving improved uniformity of definition, whence the name " Isoscope".

Further, taking advantage of the fact that the slow-speed beam can be made to give up to 100% modulation in the output circuit, some experiments have been made on the high-frequency modulation of the beam itself, so that a vision-modulation high-frequency (10 Mc/s) carrier is available at the output, leading to a simplification of the subsequent amplification process. To avoid direct excitation of the output electrode and circuit at the carrier frequency, the latter is obtained as the difference between two higher frequencies applied respectively to the cathode and the Wehnelt tube of the gun, or alternatively, to the Wehnelt tube and the output electrode of the mosaic. " All the difficulties have not yet been resolved, but the first applications of the Isoscope with high-frequency modulation are full of promise."

621.383.2 **446**

The Colour Response of Photoelectric Cells.—Sommer. (*See* 437.)

621.385.832 + 535.37 **447**

On the Question of the Upper Temperature Limit of the Luminescence of Phosphors.—P. Brauer. (*Naturwissenschaften*, Jan. 1944, Vol. 32, Nos. 1/4, p. 32.) A short note stating that a phosphor containing more than one activator has an upper temperature limit of luminescence that is different for each of the activators.

621.385.832 : 621.397.62 **448**

" Telechrome " [c.r.t. for colour television].—J. L. Baird. (*J. Televis. Soc.*, Sept. 1944, Vol. 4, No. 3, pp. 58–59.) This tube uses a separate electron beam for each colour reproduced. For two colours the two cathode-ray beams scan the opposite sides of a thin plate of transparent mica, one side being coated with a phosphor giving one colour and the other side with a phosphor giving the other colour. For three colours, one side of the screen is ridged to provide the requisite number of surfaces.

A new form of scanning reduces colour flicker by introducing colour alteration at every line instead of the present practice of changing the colour only with each successive frame.

621.396.9 **449**

Practical Radar : Part 6 [Display systems].—McQuay. (*See* 330.)

621.396.97.029.62 **450**

U.H.F. and Post-War Broadcasting.—Jones & Bell. (*See* 424.)

621.397 **451**

Color Television.—P. C. Goldmark, J. N. Dyer, E. R. Piore, & J. M. Hollywood. (*J. Soc. Mot. Pict. Engrs*, Apr. 1942, Vol. 38, No. 4, pp. 311–354.) See 481 of 1943.

621.397 **452**

Colour Television, Part II.—P. C. Goldmark, E. R. Piore, J. M. Hollywood, T. H. Chambers & J. J. Reeves. (*J. Televis. Soc.*, Mar. 1944, Vol. 4, No. 1, pp. 19–24.) Long summary of 3452 of 1943.

621.397 **453**

Television Terms and Definitions.—(*J. Televis. Soc.*, Sept. 1944, Vol. 4, No. 3, pp. 65–67.) About 40 terms taken from B.S.204:1943 of the British Standards Institution.

621.397 **454**

Objectives for Post-War Television.—W. Miner. (*J. Televis. Soc.*, Mar. 1944, Vol. 4, No. 1, pp. 13–16.) Reprint of 1628 of 1944.

621.397 **455**

A Survey of the Problems of Post-War Television.—B. J. Edwards. (*J. Televis. Soc.*, Mar. 1944, Vol. 4, No. 1, pp. 10–12.) Extract from 1109 of 1945.

621.397 **456**

Post-War Television.—British Institution of Radio Engineers. (*J. Televis. Soc.*, Sept. 1944, Vol. 4, No. 3, p. 71.) An extract from "Report on Post-War Development in the Radio Industry". It is proposed that the service should be broadcast, not wired; that carrier frequencies and video band-width should be of the same order as in pre-war practice. Vestigial side-band transmission, a 25% increase in the number of lines per frame, and a maximum modulation frequency of 3.25 Mc/s, are also suggested. The sound transmission should be part of a nation-wide u.h.f. high-quality sound service.

621.397 **457**

American Proposed Standards for Post-War Television.—(*J. Televis. Soc.*, Dec. 1944, Vol. 4, No. 4, pp. 94–96.) Reprint of 846 of 1945.

621.397 **458**

Television after the War.—O. J. Russell. (*J. Televis. Soc.*, Sept. 1944, Vol. 4, No. 3, pp. 60–63.) A plea that the technical development of television should not exclude its progress as an art; that it should attempt to produce its own art form, rather than imitate cinema practice. In particular, it is suggested that a screen ratio of height/width of 3/2 would be aesthetically satisfying for use with the type of subject most appropriate to television and would give technical advantages in improved definition without increase of band width. A table shows the improvement in definition possible in plain, stereoscopic and colour images by using different frame ratios.

621.397 **459**

The Pye "Videosonic" Television System.—D. I. Lawson. (*Electronic Engng*, Dec. 1945, Vol. 17, No. 214, pp. 814–815.) An account of the system described in 230 of January. See also *Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 371–372.

621.397.61 **460**

Mobile Television Equipment.—R. L. Campbell, R. E. Kessler, R. E. Rutherford & K. V. Landsberg. (*J. Soc. Mot. Pict. Engrs*, July 1942, Vol. 39, No. 1, pp. 22–36.) Description of an equipment comprising 15 light-weight units including (a) Synchronizing generator (2 units) incorporating a monitoring c.r.o., supplying signals for horizontal sweep, vertical sweep, composite blanking and composite synch. Several camera chains may be controlled by one generator. (b) Camera control unit, using a 5-stage video amplifier. Two blanking slippers are operated by means of low-impedance diode limiters. The video output from the camera has a high-level cathode-loaded stage for use with the amplifier, and a low-level stage for the electronic view-finder and monitor.

621.397.62 **461**

Problems of Theater Television Projection Equipment.—A. H. Rosenthal. (*J. Soc. Mot. Pict. Engrs*, Sept. 1945, Vol. 45, No. 3, pp. 218–240.) Light storage and light modulation of a standard source are necessary to obtain theatre television projection comparable with motion picture projection. In the Supersonic system, supersonic waves of frequency 10–20 Mc/s are created in a liquid by a piezoelectric plate excited by an electronic oscillator, which is amplitude modulated by the television signals. Light from a standard source is passed through the liquid and is diffracted an amount dependent upon the amplitude of the supersonic waves. With a liquid column of 2 inches about 250 picture elements of a 525-line frame can be projected simultaneously. The movement of the picture elements across the projection screen can be stopped by the use of a rotating mirror polygon to give a compensating movement. This system has been used regularly on a commercial scale.

In another system being developed, light from a standard source is passed through the screen of a Skiatron tube; the amount of light transmitted by any portion of the screen is varied by scanning the screen with a television-signal-modulated cathode-ray beam. A high storage effect is obtained by retaining the transmission values unchanged over the frame period.

Both systems can be readily adapted for colour television by the additive successive colour method by placing a small filter disk in the optical system where the light beam is small. The Skiatron system can also be used with the more efficient subtractive successive-colour method by passing the light through successive screens of suitable materials.

621.397.62 **462**

Some Aspects of Large Screen Television.—T. M. C. Lance. (*J. Televis. Soc.*, Dec. 1944, Vol. 4, No. 4, pp. 82–88. Discussion p. 89.) A brief description of Baird's and Karolus's bank of lamps giving low-definition projection, and of the Kurt Rosenberg system using cinema films projected onto a bank of 1 026 photocells at 20 frames a second, in which each cell is connected to the grid of a mercury-gas triode and excites four 6 W lamps on a large sign board. The board consisting of 4 104 lamps measures 30 × 20 ft and consumes 10 kW on full modulation.

Methods of projecting high-definition c.r. screens are discussed, and a brief description given of a method of applying the Schmidt camera for illuminating a 15 × 20 ft screen.

After a brief description of Diavisors, the Rosenthal system, and the proposed Donal and Langmuir projection system, a description is given of Fisher's equipment developed in Switzerland. Light from a powerful source passes through two grids, between which there is a liquid film 0.1 mm thick; the grids are arranged so that when the surface is undisturbed light is not transmitted. The surface can be deformed by electrostatic means, and when this occurs refraction of the beam gives an output which is a function of the degree of deformation. Much ancillary equipment is involved and so far no information is available as to the degree of contrast or screen illumination achieved by this method.

621.397.62 **463**

Extended-Range Television Reception : Part 1.—M. P. Wilder. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 18–22, 112.) A detailed description of a television receiver (51 Mc/s) with which the author has had good reception for a considerable proportion of the transmission time at 90 miles distance and 1 000ft below the line of sight. A noise limiter is an important element. The first of three parts.

621.397.7 **464**

7,000 Hours Experience in Television Service.—H. R. Lubcke. (*J. Televis. Soc.*, Dec. 1945, Vol. 4, No. 4, pp. 91–92.) A synopsis of the development of television technique by the Don Lee Broadcasting System of America (Station W6XAO). A list of references to papers and patent specifications is given. Synopsis of a paper in *Electronic Industries*, July 1944, Vol. 3, No. 7, p. 110.

621.397.7 **465**

Some Engineering Aspects of Portable Television Pick-Ups.—H. R. Lubcke. (*J. Soc. Mot. Pict. Engrs*, Dec. 1942, Vol. 39, No. 6, pp. 384–390.) The experiences at Station W6XAO.

TRANSMISSION

621.396.61 **466**

War Reporting Equipment Used by the B.B.C.—W. D. Richardson & P. H. Walker. (*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 377–379.) During the campaign in Europe mobile transmitters were used by the B.B.C. to transmit news to England. A 500–15 000 kc/s, 250 W, transmitter was mounted on lorries and trailers complete with power supply, stores, and a small studio. Two $7\frac{1}{2}$ kW short-wave sets, less highly mobile, were used for transmitting over the longer distances.

621.396.61.029.58 **467**

Engineering British B48 Walkie Talkies.—*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 104–108..142.) This portable transceiver covering the range 6 to 9 Mc/s follows the main details of its prototype the British Army Wireless Set No. 18. . The space economy of a common antenna coil for both the receiver input and the transmitter tank circuit has been dispensed with resulting in improved electrical performance. The most noteworthy additions are a crystal calibrator and a hand-generating set.

621.396.61.029.62 **468**

An A.M.-F.M. Transmitter for 50 Mc.—E. P. Tilton. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 23–26.) Output 40 W, with crystal or v.f.o. control.

621.396.61/.62].029.62 **469**

Converting 112-Mc Gear for 144.—P. S. Rand : W. E. Bradley. (*QST*, Oct. 1945, Vol. 29, No. 10, pp. 72–73, 116.) A description of the modifications necessary to operate 112 Mc/s transmitting and receiving equipment on the 144–148 Mc/s band, in particular the Abbott TR-4 and various *QST*-designed units.

621.396.61.029.64 **470**

Army Set No. 10.—(*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 383–384.) The use of centimetre wavelengths for military communications gives high security from interception by the enemy because radiation can be beamed and because surrounding hills form an effective screen. The No. 10 set is a centimetre-wavelength, pulse-modulation, trailer-mounted British army communications equipment that can handle eight speech channels simultaneously.

621.396.611.21 **471**

Harmonics in the Piezo-Electric Oscillation of a Quartz Crystal.—L. C. Tsien & H. C. Chu. (*Nature, Lond.*, 6th Oct. 1945, Vol. 156, No. 3962, p. 424.) A quartz crystal driven by a Hartley oscillator can be forced to vibrate over a wide range of frequencies, especially at $(p + 1)\, f/2$ where f = crystal fundamental frequency, p = integer ; the odd harmonics are much stronger than the even. In a Pierce circuit with weak feed-back only the fundamental and odd harmonics are obtained.

621.396.611.21 : 621.396.615.14 **472**

Crystal Control in the New Ham Bands.—J. Holmbeck. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 38–39.) A description of heterodyne methods whereby 1.75, 3.5 and 7 Mc/s crystals can be used to control oscillators in the 144, 50 and 21 Mc/s bands.

621.396.615.14 **473**

Getting Acquainted with the "Lighthouse" Tube.—P. S. Rand. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 11–14.) A simple tuned-line transmitter for the 144, 220 and 420 Mc/s bands. Bands are selected by changes of line length, tuning over the band is by a capacitor at the end of the line.

621.396.615.17 : 621.317.361 **474**

Automatic Control for Locked Oscillator.—W. A. McCool. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 39–40.) Increased stability of a multivibrator with locking-voltage amplitude variations is obtained by supplying a plate voltage derived from the locking signal. Summary of U.S. Patent No. 2 377 894.

621.396.619 **475**

Modulator.—R. C. Shaw. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 42, 58.) High-fidelity amplitude-modulation of a carrier wave is produced by variation of amplifier feedback in accordance with the modulation signal. Summary of U.S. Patent No. 2 379 042.

621.396.619 **476**

The Input and Efficiency of Class B Modulators.—Grant. (*See* 310.)

621.396.619.018.41 **477**

Wave Length Modulation.—M. G. Crosby. (*Radio*, Oct. 1945, Vol. 29, No. 10, p. 42.) A method of obtaining crystal control of a frequency-modulated transmitter. Summary of U.S. Patent No. 2 375 527.

621.396.619.018.41 **478**

A Delay Line Frequency Modulator.—D. Weighton. (*Wireless Engr*, Dec. 1945, Vol. 22, No. 267, pp. 581–586.) A method of phase modulating a crystal-controlled signal giving larger phase deviations than other methods. The crystal-controlled signal is mixed with an f.m. signal from a reactor-valve modulator, and the difference component is passed through a delay line, after which it is mixed with the f.m. signal to give the original centra frequency as the summation component. The effects of distortion in the reactor-valve modulator and in the delay line are estimated and their influence on design is discussed. For 2% harmonic distortion and a 1 db drop at 10 kc/s a phase shift of not less than 12 radians and probably up to 90 radians can be realized.

621.396.619.018.41 : 621.396.611.21 **479**

Crystal-Controlled Frequency Modulation.—S. K. Lewer. (*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 367–370.) The use of an X-cut quartz crystal to control the frequency of a master oscillator, this frequency being varied by the application to the crystal of voltages at modulation frequency. Adequate frequency deviation may be obtained by frequency multiplication followed by the use of the heterodyne principle, a process which may be repeated several times.

621.396.619.1 **480**

Keying of Radio Frequency Transmitters.—H. J. H. Wassell. (*Marconi Rev.*, July/Sept. 1945, Vol. 8, No. 78, pp. 77–88.) The problems are surveyed and summarized. The desirable characteristics of the radiated signal under c.w., m.c.w., and voice-keyed carrier operation, are considered with particular reference to signal shape, the constancy of the radio frequency, and the elimination of unwanted radiation. Means of equalizing the load on the power supply during space and mark periods are examined. Keying control circuits incorporating design features imposed by the considerations outlined above are described in detail. A short section deals with the provision of " listening through " facilities in hand-speed two-way telegraphy links.

621.396.645.31 **481**

Using the New High-Power Beam Tubes.—D. Mix. (*QST*, Oct. 1945, Vol. 29, No. 10, pp. 67–68, 116.) A description of an amplifier using Eimac 4–125 A screen-grid tubes suitable for 28, 14, 7 and 3.5 Mc/s, and capable of handling a power input of 1 kW, and a two-stage transmitter using HK 257–B pentodes delivering 200 W on the above frequencies.

621.396.8.029.63/.64 **482**

Microwave Transmission Power Requirements.—J. E. Browder & V. J. Young. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 30–34, 64..67.) The factors involved in obtaining satisfactory microwave communication are discussed, and a " balance sheet " method of calculation presented. On the " gain " side are oscillator power, gain of transmitting and receiving antennae, and perfect-receiver sensitivity. On the " loss " side are transmitter and receiver cable losses, " isotropic " transmitter and receiver antennae characteristics, propagation loss and receiver noise figures. Typical numerical values of these quantities are given graphically and examples of required transmitter power worked out. The effect of reflection interference on propagation loss is briefly considered.

621.396.931/.933].2 : 621.396.61 **483**

Calibrating Transmitters, Types TV.10, TV.11 and TV.12.—Tooley. (*See* 337.)

VALVES AND THERMIONICS

621.385 **484**

Valve [colour] **Coding.**—K. E. Marcus. (*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 384–385.) A letter adding to 246 of January. Colours for heater ratings, but letters to represent functions.

621.385 **485**

Space Charge between Coaxial Cylinders.—L. Page & N. I. Adams, Jr. (*Phys. Rev.*, 1st/15th Sept. 1945, Vol. 68, Nos. 5/6, pp. 126–129.) " New solutions of the space charge equation are obtained, which converge much more rapidly than Langmuir's solution in the important case where the radius of the outer electrode is large compared with that of the inner electrode."

621.385 : 531.314 **486**

Dynamics of Electron Beams.—Gabor. (*See* 362.)

621.385 : 621.317.79 **487**

Vacuum Tube Analyzer.—Sands. (*See* 381.)

621.385.1 + 621.396.11.029.64 + 621.396.24 **488**

Simultaneous Use of Two New Radiocommunication Techniques : Centimetre Waves and Frequency Modulation.—Clavier & Altovsky. (*See* 402.)

621.385.3 (091) **489**

Saga of the Vacuum Tube : Part 20.—G. F. J. Tyne. (*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 51..120.) A description of the construction and manufacturing difficulties of some early British valves developed for use during the 1914-18 war.

621.385.34 **490**

Transmitter Valves-I. — M. Matricon, J. Chantereau, R. Montagne & A. Laurent. (*Onde élect.*, Nov. 1945, Vols. 20/25, No. 224, pp. 116–127.) A detailed description of new types and designs of external-anode transmitting valves, and of corresponding new manufacturing techniques developed by the French Thomson-Houston Co.

Distinctive features of these designs are (1) the elimination of any deep concavities in the glass parts of the envelopes, which were inconvenient and ill adapted for cooling : (2) termination of the control grid on a metal ring electrode fused into the glass along its top and bottom edges : (3) the use of pre-formed accurately-moulded glass elements of size and shape suitable for assembly by eddy-current heating, and the complete elimination of the glass-lathe and gas-jet technique.

MISCELLANEOUS

001.891 **491**

The Work of the [British] **Department of Scientific and Industrial Research.**—E. V. Appleton. (*J. roy. Soc. Arts*, 22nd June 1945, Vol. 93, No. 4694, pp. 372–382. Discussion, pp. 382–384.) The Department is responsible for the organization of scientific research over a very wide field. It has established, or controls, ten national research laboratories of which the National Physical Laboratory is the largest, and encourages industrial participation in research through a number of Research Associations. The scope of these laboratories is briefly described and some indication is given of the useful work they have accomplished.

001.891 **492**

A Plan for Research in the United States.—(*Nature, Lond.*, 4th Aug. 1945, Vol. 156, No. 3953, pp. 130–132.) A review of the Bush report " Science—the Endless Frontier". See also 493 below, 4095 of 1945 and back references.

001.891 **493**

Conditions for the Promotion of Research.—(*Nature, Lond.*, 4th Aug. 1945, Vol. 156, No. 3953, pp. 125–128.) Editorial comment on 492 above.

001.891 : 621.38 + 347.771 : 621.396.9 **494**

Some Navy Electronics Problems and a Proposal for a Radar Patent Pool.—J. B. Dow. (*Elect. Engng, N.Y.*, Mar. 1945, Vol. 64, No. 3, pp. 87–91.) A well-organized research programme of adequate scope would maintain the progress made during the war years. More attention should be devoted to standardization of components and to a more thorough testing of their dependability under all conditions of use. If the progress made in radar techniques is to be made generally available without undue delay, a solution of the patent problem is essential, and it might be found in a patent pool.

001.891 (47) **495**

Electrical Research in the U.S.S.R.—G. Oster. (*Proc. Instn Radio Engrs, Aust.*, Aug. 1945, Vol. 6, No. 2, pp. 6–8.) A reprint of 2409 of 1945.

02 **496**

Association of Special Libraries and Information Bureaux : Annual Conference.—(*Nature, Lond.*, 17th Nov. 1945, Vol. 156, No. 3968, pp. 605–607.) Papers and discussions on the planning and equipment of research libraries, links with the U.S.A., reference books, and the circulation of scientific information both as individual papers and in abstract.

06.054 **497**

The Presentation of Technical Developments before Professional Societies.—W. L. Everitt. (*J. Soc. Mot. Pict. Engrs*, Sept. 1945, Vol. 45, No. 3, pp. 184–190.) A reprint from *Proc. Inst. Radio Engrs, N.Y.*, July 1945, Vol. 33, No. 7, p. 423.

061.231 : 62 **498**

The Engineer and his Future.—C. A. Powel. (*Elect. Engng, N.Y.*, Jan. 1945, Vol. 64, No. 1, pp. 14–16.) Engineers have not had sufficient public recognition. There is a need for an association of all branches of the profession, apart from the technical societies, to represent the engineer in civic and state affairs.

061.231 : 62 **499**

Organization of the Engineering Profession.—J. F. Fairman. (*Elect. Engng*, June 1945, Vol. 64, No. 6, pp. 220–223.) The author favours an all-inclusive association of professional engineers with one grade of membership, rather than a federation of existing societies.

172.1 : 62 **500**

Civic Responsibilities of Engineers. — (*Elect. Engng, N.Y.*, July 1945, Vol. 64, No. 7, pp. 251–252.) Wider participation of engineers in public affairs is advocated in this report by an AIEE committee.

347.771 **501**

Invention and Patents.—W. E. Burnand. (*Elect. Rev., Lond.*, 9th Nov. 1945, Vol. 137, No. 3546, pp. 687–688.) The present system discourages invention by high fees, uncertainty as to the protection afforded, certainty of heavy expense in upholding this very uncertain protection, and the apprehension that, if an invention is successfully developed, some prior patent may be discovered that will deprive the inventor of his benefits. It is suggested that special courts be set up consisting of technically-trained persons assisted by legal persons acting only in an advisory capacity. Such courts would make reasonable awards to the inventor, which would be reviewed from time to time, depending upon the value of the invention to the general well-being of the community.

51 : 53 **502**

Mathematical Theory vs. Physical Concept.—E. H. Armstrong. (*Proc. Instn Radio Engrs, Aust.*, July 1945, Vol. 6, No. 1, pp. 12–14). A collection of quotations from text-books and journals in which frequency-modulation was belittled and adversely criticized on theoretical grounds. "It was in the face of these barriers of false conclusions that the experimental method based on physical reasoning laid bare the hidden phenomena which led to the invention of the f.m. system." The author also quotes, however, an article by Carson and Fry which gives a mathematical demonstration and exact calculation of the gain in signal/noise ratio obtainable from f.m. systems, and which incidentally refers to the illusory character of some of the earlier claims.

519.283 **503**

Statistical Tools for Controlling Quality.—J. Manuele & C. Goffman. (*Trans. Amer. Inst. elect. Engrs*, July 1945, Vol. 64, No. 7, pp. 524–528.) An elementary description of how statistical concepts—for example, standard deviation, and average value of a number of observations—may be used to detect aberrations in manufacturing processes.

535.767 : 535.88 **504**

A Stereo-Episcope.—W. E. Curtis & T. A. Littlefield. (*J. sci. Instrum.*, Nov. 1945, Vol. 22, No. 11, pp. 215–218.) The images of a stereoscopic pair projected on a special screen are seen in relief by use of either Anaglyph or Polaroid filters and spectacles. Details of the construction and of the adjustment procedure are given.

551.509 : 621.3 **505**

Meteorology-Aid to Electrical Engineers.—F. J. Mahaffy. (*Elect. Engng, N.Y.*, Aug. 1945, Vol. 64, No. 8, pp. 290–294.) An examination of recent advances that have broadened the range and scope of weather prediction, the factors entering into the forecasting process and of specific meteorological information the electrical industry can expect for aid in both its long-range and day-to-day operations.

6 : 623 **506**

The Influence of Research on Victory in War.—J. C. Ward, Jr. (*Elect. Engng, N.Y.*, April 1945, Vol. 64, No. 4, pp. 133–138.) A short discussion on the relations between American government agencies (ministries) and industry in the fields of research and development, followed by a justification of the need for continuous research. The scale and type of problems encountered during the war in achieving technical superiority over the enemy, are illustrated with examples drawn mainly from the aeronautical field. Statements by various heads of American development laboratories are included, dealing with their particular achievements and future requirements.

6(07) : 62 **507**

Explorations in Engineering Education.—A. B. Bronwell. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 735–740.)—Analysis of recommendations from sections of I.R.E. for changes in the system of engineering education required to meet modern needs. Educators in answer suggest three curricula (1) normal training for the majority (2) management and (3) scientific-technical.

614.825 **508**

Safety.—AIEE Committee on Safety. (*Elect. Engng, N.Y.*, Jan. 1945, Vol. 64, No. 1, pp. 44–45.) Electric shocks and burns are a major problem in the power industry. References are given to two recent developments in artificial respiration.

620.193(213) : 621.396.6 **509**

Tropic-Proof Components : A Reader's Experience [in Malaya].—R. C. Joyce. (*Electronic Engng*, Sept. 1945, Vol. 17, No. 211, p. 698.)

620.193.7 : 621.315.221 **510**

Electrolysis and Corrosion of Underground Power-System Cables.—L. J. Gorman. (*Trans. Amer. Inst. elect. Engrs*, June 1945, Vol. 64, No. 6, pp. 329–336.) An account of the extensive experience of the Consolidated Edison Co. of New York on the various types of corrosion to which cables are liable and the best means of their prevention. For discussion see *Trans. Amer. Inst. elect. Engrs*, June Supplement 1945, Vol. 64, pp. 479–482.

620.193.7 : 621.315.221 **511**

Study of A.C. Sheath Currents and their Effect on Lead-Cable-Sheath Corrosion.—C. M. Sheier & K. J. Granbois. (*Trans. Amer. Inst. elect. Engrs*, May 1945, Vol. 64, No. 5, pp. 264–268.) An account of two cases in which the lead sheaths of cables have been corroded through electrolytically, the initial corrosion being accelerated by rectified alternating currents induced in the sheath by the load current. Protection can be obtained by applying to the sheath a small negative bias with respect to earth by means of a dry battery. For discussion see *Trans. Amer. Inst. elect. Engrs*, June Supplement 1945, Vol. 64, pp. 483–484.

621–526 : 621.314 **512**

Servo-Mechanisms.—D. C. Bomberger. (*Bell Lab. Rec.*, Nov. 1945, Vol. 23, No. 11, pp. 409–411.) A servo mechanism is similar in principle to an electronic feed-back amplifier in that a large output power can be controlled by a small signal. Stability problems also are similar in the two devices.

621.3(091) **513**

100 Years of Electricity and Electronics.—V. Zeluff & J. Markus. (*Sci. Amer.*, July 1945, Vol. 173, No. 1, pp. 7..16.) A review of developments in the electrical and electronic industries during the past century. Pioneer work is described on electric lighting, X-ray tubes, wire communication, radio and television. Prospects of the future applications of radar and industrial electronics are discussed.

621.3.017.72 **514**

Contribution to the Problem of the Thermal Circuit in Electrical Machines and Apparatus.—L. Cigánek. (*Arch. Elektrotech.*, Jan./Feb. 1944, Vol. 38, Nos. 1/2, pp. 29–34.) Equations are derived for the temperature distribution in a rectangular bar when heat enters at one end and is all given up to the surrounding medium from the surface of the bar. The cases are then treated of two bars of different section connected in parallel, draining a heat source, and of two bars of different section connected in series to the heat source. Numerical examples of the application of the formulae are worked out, and the temperature distribution at the contact point of a switch is discussed briefly.

621.313 + 621.315] (23.03) **515**

Effect of Altitude on Electric Apparatus.—L. M. Robertson. (*Elect. Engng*, June 1945, Vol. 64, No. 6, pp. 214–216). "Increase of altitude results in decrease of air density, heat dissipation by convection, dielectric strength of air, windage losses, ambient temperature and humidity, and this affects operation of some electric apparatus. Corona loss, lightning currents, commutation, and earth resistance also are affected." The data given chiefly concern the operation of electrical machinery and transmission lines in mountainous districts.

621.315.616.9 + 679.5](213) **516**

Properties of Plastics [in tropical conditions]. S. Rogerson : W. J. Tucker : P. I. Smith. (*Electronic Engng*, Sept. 1945, Vol. 17, No. 211, p. 698.) Correspondence arising from 3044 and 3359 of 1945.

621.327.43 + 621.385.132 **517**

Fluorescent Lamps.—H. G. Jenkins. (*G.E.C. J.*, Aug. 1945, Vol. 13, No. 4, pp. 185–198.) The development of fluorescent lamps is reviewed. The cold-cathode high-voltage types were extensively used before the war and their properties make them suitable for special lighting problems. For more general use, hot-cathode low-voltage types have now been developed, and a description is given of their properties and installation.

621.396 : 134 **518**

Telepathy—Or should it be Radio-Telepathy?—"Radiophare". (*Wireless World*, July 1945, Vol. 51, No. 7, pp. 214–216.) A review of some of the evidence for the existence of telepathy, and speculation as to the connection between telepathy and h.f. radiation. See also 4112 of 1945.

621.396.6(213) **519**

Tropical Treatment of Military Equipment.—W. F. Horner & F. R. Koppa. (*Electronic Industr.*, July 1945, Vol. 4, No. 7, pp. 106–108, 150..162.) The two main causes of deterioration are fungoid growths and moisture absorption. The equipment is treated and tested in respect of both effects in a laboratory in which tropical conditions are reproduced. A list of fungicides is given.

621.798(213) **520**

Recommendations for Preserving and Packaging for Tropical Theatres of War.—British Standards Institution. (*British Standard Packaging Code: Supplement 2, 1944.*)

Correction.—In the January abstracts, for *Trans. [mon.] Amer. Inst. elect. Engrs* read *Trans. Amer. Inst. elect. Engrs.*

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

In order to enhance the usefulness of the abstracts, certain changes have been made in their presentation. The subject sections have been increased in number and made more in accordance with the modern trend of development, and they are now arranged in alphabetical order. Universal Decimal Classification numbers have been added to each abstract, and heavy-face type has been adopted for the serial number and title in order to increase their legibility.

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ACOUSTICS AND AUDIO FREQUENCIES

534.321.9 : 621.396.9 **521**

Acoustic Control in the Flight of Bats.—D. W. Ewer: H. Hartridge: M. Wilkinson. (*Nature, Lond.*, 8th Dec. 1945, Vol. 156, No. 3971, pp. 692–693.) Correspondence following 258 of February (Hartridge).

534.61 **522**

A Method for Obtaining Small Mechanical Vibrations of Known Amplitude.—D. H. Smith. (*Proc. phys. Soc.*, 1st Nov. 1945, Vol. 57, No. 324, pp. 534–542.) The amplitude of a vibrating diaphragm is measured by observing interference fringes between the surface of a thin glass plate attached to the diaphragm and a fixed lens. Theory shows that the fringes disappear for certain critical amplitudes which differ by approximately $\lambda/4$. The amplitude is deduced from the number of times the fringes disappear as the amplitude is raised from zero. The instrument is suitable for a standard source of sound. In favourable circumstances the amplitude can be set to any assigned value by adjusting the current, with an error not greater than 1 in 500.

534.62 **523**

N.Y. Navy Yard's Quiet Room.—W. M. Rees. (*Communications*, Oct. 1945, Vol. 25, No. 10, p. 68.) A description of a room in which ship microphones, telephones, loudspeakers, etc., can be calibrated. The elaborate precautions to ensure the exclusion of external noise and to minimize sound reflection from the walls, ceiling and floor of the room are given in detail.

534.851 **524**

The Error in the Light-Bandwidth Measurement on Gramophone Records.—R. Bierl. (*Akust. Z.*, May 1940, Vol. 5, No. 3, pp. 145–147.) An exact calculation of the theory of light-bands on records gives an expression for the error in the approximate formula given by Buchmann and Meyer (1930 Abstracts, p. 458.) as a two-part correcting term. The first part represents the fact that the extreme reflection point is not at the point of greatest slope, which gives an error not greater than 1%. The second represents an error at small radii, amounting to about 3% for a radius of 4 cm on a 78 turn/min record, and 6% for a 6 cm radius on a $33\frac{1}{3}$ turn/min record.

534.851.6 **525**

Results of Phono Needle Tests.—Consumers Union of U.S. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 99, 143.) Data from *Consumer Reports* on tests for fidelity and record wear of "permanent" gramophone needles. Needles were used for several thousand playings and the increased noise level measured electrically.

534.862.3 **526**

A Multisection Rerecording Equalizer.—W. L. Thayer. (*J. Soc. Mot. Pict. Engrs*, Nov. 1945, Vol. 45, No. 5, pp. 333–338.) "This paper describes an assembly of 5 equalizers [for film recording] arranged so that they can be controlled by one hand, thereby leaving the other hand free for dialogue level adjustments. The equalizers are capable of lowering or raising the response in 5 different frequency bands without creating changes in reproduced level."

621.395.61/.62] : 621.317.39 **527**

Curve-Tracer for Acoustic Devices.—R. K. Hellmann. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 130–133.) The frequency of a beat-frequency oscillator is varied by a motor drive which also actuates a potentiometer controlling the horizontal position of the spot on a long-persistence screen of a cathode ray tube. The beat-frequency oscillator is connected to the acoustic device under test, the sound output being received by an artificial ear and passed through an amplifier to give a vertical deflexion to the cathode ray beam. The response curves obtained in this way have been used for the quality control of full scale production of handset receivers over a period of five years.

621.395.623.7 + 621.396.623 + 534.43 **528**

"High Fidelity".—A. C. Matthews. (*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 33..74.) Data on a wide range of subjective tests are given. The objective requirements in respect of frequency and volume ranges and of noise levels in relation to f.m. transmissions and gramophone reproduction are discussed. Room acoustics and speaker directivity as well as listening habits receive attention. The approach to perfection is finally a matter of economics.

621.395.623.7 : 621.392.53 **529**

Woofer-Tweeter Crossover Network.—P. W. Klipsch. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 144–145.) Details of design of two simple filters operated in parallel as the load for the push-pull triodes of an a.f. amplifier. They are constructed of inexpensive materials and enable a low-frequency horn and a high-frequency horn to be operated together to give a response flat within 2 db in the range 30–10 000 c/s.

621.395.623.8 **530**

An Improved [two-way] **Loudspeaker System for Theaters.**—J. B. Lansing & J. K. Hilliard. (*J. Soc. Mot. Pict. Engrs*, Nov. 1945, Vol. 45, No. 5, pp. 339–349.) "New permanent magnet low-frequency and high-frequency units having replaceable diaphragms are described. These units are combined in a horn system having the following advantages: a higher efficiency, extended frequency range, permanent magnet units providing higher air gap flux densities, elimination of back-stage radiation from the diaphragms, better transient response, and an improved over-all presence."

621.395.623.8 **531**

Sound Distributor.—(*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 25..28.) A non-directional resonator and sound distributor built up from five separate loud speakers arranged round the faces of a 24 inch cubical "reproducing chamber" is claimed to provide musical "depth" by virtue of optimum blending of the separate tonal responses. The acoustical quality is such that this single outlet can replace the usual 25–50 loudspeakers in a large auditorium. Summary of a paper by C. A. Volf (reference not given).

621.395.623.8 **532**

A 9-Speaker Battle Announcing System.—H. W. Duffield. (*Communications*, Oct. 1945, Vol. 25, No. 10, pp. 48–50.) "The system's frequency response rises from about 250 to 500 cycles and then is reasonably flat at 6 000 cycles at which point it decreases. It is capable of creating a sound level of about 116 db above the reference level of 0.000 204 dyne per square cm, at a distance of 30ft from the loud speakers. The major part of the energy is radiated through a cone of 50°." Diagrams of the amplifier (output 250 W) are given, and the loudspeakers are described.

621.395.623.8 **533**

Modulated-Air Super Speaker.—(*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 426..430.) Air at 20 to 25 pounds/sq inch pressure is pumped through an electro-mechanical modulator to the horn. The modulator comprises thirty-four 0.006 inch slits, the apertures of which are controlled by the currents in the speech coil. Acoustic power output 15 to 20 W.

621.395.625.2 + 534.43 **534**

Improving Recordings.—N. C. Pickering. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 82..214.) "How to get the most out of phonograph recordings." Eccentricity of the centre hole of a record of as little as .008 inch may cause objectionable variations in pitch, and non-uniform speed produces distortion ("wow"). High-frequency response which does not accentuate some harmonics and attenuate others is desirable, and harmonic distortion should be avoided. Methods of volume expansion are described.

621.395.625.2 + 534.43 **535**

Crystal [gramophone] **Pickup Compensation Circuits.**—B. B. Bauer. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 128–132.) "From consideration of recording practice, record properties, pickup frequency characteristics, and listener acceptance, the appropriate corrective network for connecting crystal pickup to amplifier input to give desired overall frequency response is determined."

621.395.625.2/.3 **536**

Some Aspects of Sound Recording.—V. M. Brooker. (*Proc. Instn Radio Engrs, Aust.*, Sept. 1945, Vol. 6, No. 3, pp. 3–7. Discussion, pp. 7–9.) Magnetic recordings are made on tungsten steel tape 0.08 mm thick and 3 mm wide moving at 5 ft/s; alternatively carbon steel (0.5 or 0.8% C) wire of about 0.003 inch diameter is used. A wiping head magnetizes the wire to saturation and the recording head applies local variations in the magnetization which follow the a.f. signal. Background noise is dependent on the quality and uniformity of the tape, and can be improved by superposing an h.f. component of about 30 kc/s on the a.f. current to the recording head. Disks of ethyl cellulose, operated at a constant groove speed, are used in embossing systems of recording; the weight of the recording head is critical. Scratch and rumble noises, the ionization treatment of wax masters, and sapphire cutting tools are discussed.

621.395.625.2 **537**

Recorder on Tape has Voice Control.—J. M. Lee. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 167..189.) The Hartron, formerly the Recordgraph, records at 60 ft/min on embossed grooves on a 50-foot film belt: there are 115 parallel grooves. The starting and stopping is voice-controlled. Immediate playback to a p.a. system or to the modulator of a radio transmitter is possible. The equipment is easily portable and was used for battle recording.

621.395.625.3 **538**

Magnetophon Tape Recording Equipment.—(*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 234..238.) Account of an observer's report on a German device. Tissue-thin tape made of plastic impregnated with iron oxide is used for magnetic recording. The recordings have a frequency range of 50–8 000 c/s with some response at 12 000 c/s. The tape can be cut and spliced with ease.

621.395.625.3 **539**

Postwar Recorders Show New Ideas.—I. Queen. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 176, 185.) Recorders for home and office use will soon appear on the market. A typical instrument is $7\frac{3}{4} \times 4 \times 1\frac{3}{4}$ inches in size, weighs 3 lb, and carries sufficient 0.003 inch diameter steel wire to give $2\frac{1}{4}$ hours recording time.

621.395.641 **540**

Discussion on "Modern Submarine Cable Telephony and the Use of Submerged Repeaters".—R. J. Halsey. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 279–280.) Discussion on 1100 of 1945.

621.395.667 **541**

A True Tone Control.—G. Bertsche. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 97..123.) A simple condenser-resistance network which can be calculated to give any required bass or treble boost and attenuation. The attenuation equation is given.

621.396.62 **542**

[Receiver] Power Output Stages.—King. (*See* 722.)

AERIALS AND TRANSMISSION LINES

621.315.2(091) **543**

From the Single-Strand Overhead Telephone Line to the Modern High-Frequency Cable.—D. (*Bull. schweiz. elektrotech. Ver.*, 14th Nov. 1945, Vol. 36, No. 23, pp. 789–791. In German.) An historical survey of cable technology.

621.315.213.12 : 621.317.3.029.58/.62 **544**

Apparatus for Measurements on Balanced-Pair High-Frequency Cables in the Range 10-200 Mc/s.—Simmonds. (*See* 667.)

621.315.229 **545**

Jacketing Materials for H-F Transmission Lines.—Warner. (*See* 631.)

621.392 **546**

Waves and Wave Guides.—G. G. (*QST*, Dec. 1945, Vol. 29, No. 12, pp. 53..102.) Continuation of 284 of February.

621.392 **547**

The Capacity of Twin Cable.—Craggs & Tranter. (*See* 660.)

621.392.012.2 **548**

New Transmission-Line Diagrams. — A. C. Schwager & P. Y. Wang. (*Trans. Amer. Inst. elect. Engrs*, Sept. 1945, Vol. 64, No. 9, pp. 610–615.) Three new charts are developed from those of Evans and Sels (*Elect. J.* 1922, p. 550). (a) Circle diagram for calculation of the power at one end of a transmission line when the power at the other end is known. This chart is deduced essentially by a conformal transformation between the transmitting plane and the receiving plane. (b) Circle diagram for calculation of the impedance at one end when that at the other is known. This is obtained in a similar way. (c) Universal transmission line chart for determining the essential data pertaining to the line when either the power and voltage at the same end, or the power at one end and the voltage at the other are given.

621.392.21 **549**

Solving Transmission Line Problems.—R. C. Paine. (*Communications*, Oct. 1945, Vol. 25, No. 10, pp. 66..89.) Charts of tanh and coth $(\alpha + j\beta)$ are given, with two numerical examples of their application to line problems.

621.392.21 **550**

The Application of Heaviside's Transposition Rule to the Study of the Rise of Current and Voltage in a Line.—S. Colombo & M. Parodi. (*Rev. gén. Élect.*, Oct. 1945, Vol. 54, No. 10, pp. 309–312.) The application of operational methods, in particular the use of the unit function and the transposed or delayed unit function to the study of the transient regime in uniform lines.

621.392.21 **551**

The Capacitance and Thermal Conductance of Screened Multi-Pair Systems in High-Frequency Cables.—H. R. F. Carsten. (*J. Instn elect. Engrs*, Part I, Nov. 1945, Vol. 92, No. 59, pp. 423–425.) Long abstract of 3323 of 1945.

621.396.67 **552**

Note on Broadcasting Antenna at Trivandrum.—M. K. N. Abraham. (*Electrotechnics*, Sept. 1945, Nos. 17/18, pp. 122–124.) The aerial is a vertical radiator grounded at the base, and power is supplied at a tapping approximately half-way along it. Wavelength 453.9 m, aerial length 0.169λ. See 3681 of 1937 (Morrison & Smith) for basic work.

621.396.67 **553**

Artificial Antenna.—S. Wald. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 150–154.) "Design of a two-terminal lumped-constant network that simulates, within a specified frequency band, the impedance variations of a single-wire antenna." The design is effected in terms of the following parameters :– reactance and resistance at the low frequency limit ; resonant and antiresonant frequencies ; resistance at the resonant frequency ; resistance at some frequency between the upper frequency limit and the resonant frequency ; resistance at the upper frequency limit.

621.396.674 **554**

Receiver Loop Antenna Design Factors.—E. M. Kendell. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 62, 64.) A high Q is necessary, and this must be obtained with the loop in its normal position in the receiver. Test results on solenoid, basket weave, and embossed (Airloop—see 289 of February) types of loops are given.

621.392 + 621.396.67 **555**

Transmission Lines, Antennas and Wave Guides [Book Review].—R. W. P. King, H. R. Mimno, & A. H. Wing. McGraw-Hill, New York, 1945, 347 pp., $3.50. (*Electronics*, Nov. 1945, Vol. 18, No. 11, p. 516.) See 3803 of 1945.

CIRCUITS

621.3.012 **556**

Graphical Analyses of Nonlinear Circuits.—A. Preisman. (*Quart. appl. Math.*, Oct. 1945, Vol. 3, No. 3, pp. 185–197.) The currents in the circuit are determined from the points of intersection of lines representing the linear elements of the circuits with the current/voltage characteristic curve of the nonlinear element. In the case of a non-linear resistance in series with an inductance, a finite operator curve involving $L/\Delta t$ (corresponding to Heaviside's L_p) is introduced. Similar methods are available for other reactive circuits, and when applied to a negative resistance in series with an inductance show that this circuit can produce relaxation oscillations.

Application of the method to an ideal balanced amplifier shows that the output and mid-branch currents can only contain odd and even harmonics respectively.

621.314.12 **557**

Crystal-Driven Modulator for D-C Amplifiers.—J. A. Williams. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 128–129.) The d.c. input is passed through a carbon microphone button mechanically joined to a rochelle-salt crystal. The crystal unit is excited by a constant-output 1 kc/s oscillator. The vibrations of the button convert the d.c. input to an a.c. signal which is amplified in a three-stage band-pass amplifier. A continuously variable calibration voltage is provided, and a gain control and step-attenuator in the amplifier allow for a wide range of input levels.

621.314.2 + 621.317.72] : 621.362 **558**

A.C. Amplifier and Voltmeter.—L. C. Roess. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, p. 113.) Abstract, with circuit diagram, of a paper (*Rev. sci. Instrum.*, July 1945) on an instrument for measuring thermocouple outputs down to a limit of 5.10^{-10}V. The radiation to the couple is interrupted at 1–5 c/s, and the amplifier sharply tuned to the interruption frequency.

621.316.722.078.3 : 621.385.18 **559**

Utilizing the VR-Series Tubes [for voltage stabilizers].—Anderson. (*See* 801.)

621.318.32 : 621.318.42 **560**

Ferroinductance as a Variable Electric-Circuit Element.—Ryder. (*See* 643.)

621.318.72/.73].012.3 **561**

Resistance-Capacitance Filter Chart.—E. Frank. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 164–165.) Gives values of R and C for low-pass and high-pass filters in terms of the rejection desired at any frequency from 10^{-3} to 10^{9} c/s, and gives also the reactance of a capacitor at any such frequency.

621.392.5 : 621.3.015.33 **562**

Pulse Response: A New Approach to A.C. Electric-Network Theory and Measurement.—E. C. Cherry. (*J. Instn elect. Engrs*, Part I, Dec. 1945, Vol. 92, No. 60, pp. 462–464.) Long summary of 3841 of 1945.

621.392.52 **563**

A New Kind of Filter Circuit.—T. S. Skillman. (*Communication Rev.*, 1945, Vol. 1, No. 1, pp. 39–41.) Consideration of filter circuits followed or preceded by a highly back-coupled amplifier, for use in a carrier telephone system. By the use, for example, of one simple resonant circuit, a response to frequencies "flat to within 0.2 db has been achieved over a working range where previously only something like 2 or 3 db could be achieved".

621.392.53 : 621.395.623.7 **564**

Woofer-Tweeter Crossover Network.—Klipsch. (*See* 529.)

621.394/.397].64 **565**

Analysis of Cathode Follower.—C. N. Jeffery. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 434..450.) Long summary of 2922 of 1945.

621.394/.397].645 **566**

Cathode Biased Amplifiers.—P. H. Hunter. (*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, p. 92.) "Analytical methods for determining the operating point when circuit constants and supply voltages are known."

621.394/.397].645.34 **567**

A New Method of Investigating Stability.—A. Leonhard. (*Arch. Elektrotech.*, Jan./Feb. 1944, Vol. 38, Nos. 1/2, pp. 17–28.) A theoretical and mathematical paper on the stability of electrical systems in which there is a back-coupling of energy from the output to the input terminals. It postulates that the ratio of the feed-back voltage to the input voltage can be stated in the form of a polynomial fraction function of p (the disturbance being assumed proportional to e^{pt}). Equating this ratio to unity gives a polynomial function of p. The new method consists of the substitution of $j\omega$ for p in this polynomial and the plotting of the resultant curve $H(j\omega) = 0$ in the complex plane as a function of ω. The stability of the system, and even, in many cases, approximation to the frequency and damping of the damped oscillatory modes, can be deduced from the form of this curve by certain rules which are stated and proved. It is claimed that the process is simpler to apply and wider in scope than those of Hurwitz and Nyquist, to which detailed reference is made. The process is illustrated, and compared with the former methods, by a number of examples. See also 1932 Abstracts p. 279 (Nyquist).

621.396.611.21 **568**

Crystal Oscillator Theory.—(*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 16..25.) Summary and discussion of 3324 of 1945 (Fair).

621.396.615 **569**

Notes on the Stability of LC Oscillators.—N. Lea. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 261–274. Discussion, pp. 275–279.) The stability of 2-terminal and 4-terminal oscillators is considered generally. The frequency instability (due to phase instability) and the temperature coefficient of frequency are minimized by reducing the phase error. The effects of harmonics, inter-electrode capacitances, cathode-heater coupling, photo-electric effect, microphony, and changes during warming up are briefly considered. The use of bridge stabilization and of buffer stages is discussed.

The stability of the L and C elements of the resonator depend on temperature, humidity, and mechanical effects. The performance of the variable-gap capacitance compensator is analysed.

The thermal performance of the Franklin oscillator is analysed approximately, and the results are found to be in fair agreement with measured values of the frequency deviations during warming up.

Three experimental oscillators are described and their measured stabilities given to illustrate features of design and performance discussed earlier.

It is stressed that humidity can have a serious effect, though it usually receives little attention.

621.396.615 **570**

On the Frequency Maintained by a Valve Oscillator.—J. Queffelec. (*C.R. Acad. Sci., Paris*, 5th Feb. 1945, Vol. 220, No. 6, pp. 194–196.) The tuned-anode back-coupled oscillator is treated as a class C amplifier, and the formula $\omega^2/\omega_0^2 = 1 - 1/Q^2(1 + \mu M/L)$ derived for the ratio of the oscillator frequency to the natural frequency of the tuned anode circuit in terms of the amplification factor (μ), the Q-factor and self-inductance of the tuned circuit (Q and L), and the mutual inductance (M) between the anode and grid circuits.

621.396.615.17 : 621.317.755 **571**

A Single Sweep Time Base — Part I.—D. McMullan. (*Electronic Engng*, Jan. 1946, Vol. 18, No. 215, pp. 21–23.) A modified Eccles-Jordan trigger circuit operated by negative pulses. It gives single sweeps with automatic or manual resetting. The time delay is a fraction of one microsecond. A circuit is given for the expansion of any given portion of a recurrent waveform, using an auxiliary time base.

621.396.615.17.029.62. **572**

Frequency Multiplication for the V.H.F. Bands.—Gardner. (*See* 793.)

621.396.621.54.029.6 : 621.396.611.21 **573**

Crystal-Controlled Receivers for A-M, F-M and Television.—S. X. Shore. (*Communications*, Oct. 1945, Vol. 25, No. 10, pp. 70..110.) A discussion of design features for crystal oscillators suitable for use in f.m. receivers and for the sound channel of television receivers. In the case of television receivers required to cover several channels, a bridge circuit with a number of crystals in parallel is proposed. For previous parts see 3826 of 1945 and 170 of January.

621.396.622 : 621.396.619.018.41 **574**

F-M Ratio Detectors.—R. G. Peters: S. W. Seeley. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 42..84.) Analysis of a detector system described by Seeley in an I.R.E. paper (reference not given), by which it is possible to build an f.m. receiver without a limiter. For another account see *Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 82..164.

621.396.622.6 : 546.28 **575**

Silicon Crystals for UHF Detection Circuits.—Cornelius. (*See* 771.)

621.396/.397].645.31 **576**

Some Considerations in the Design of Wide-Band Radio-Frequency Amplifiers.—J. E. Cope. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 237–246.) Theoretical and practical consideration of sensitivity, bandwidth, amplitude linearity, gain control, electrical stability, and paralysis. Particular reference is made to television amplifiers for 45 Mc/s with a bandwidth of 4 Mc/s. The design of the input circuit for maximum sensitivity gives a noise factor of 6 db. Inter-stage coupling is arranged to give adequate stage gain consistent with bandwidth and phase linearity requirements.

Diode and anode-bend detectors are compared; the push-pull diode is best. Methods of gain control and their effect on the input capacitance are considered, but no fully satisfactory method exists.

Regeneration is influenced by valve effects, filtering, chassis materials, earthing points, coil screening and decoupling condensers, and means of reducing it are suggested.

Paralysis by impulsive interference can be countered by making the l.f. impedance of the decoupling circuits as small as possible.

621.396.645.31 **577**

Role of the Neutralizing Capacitor in Tuned Power Amplifiers.—W. Pritchett. (*Communications*, Oct. 1945, Vol. 25, No. 10, pp. 52..84.) An analysis giving consideration to the problem of wide-band neutralization, and to factors influencing the design of neutralizing capacitors.

621.396.662.2.076.2 **578**

Permeability Tuning.—W. J. Polydoroff. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 155–157.) A survey of the technique and advantages in typical receiver applications. "Using the same geometrical dimensions of core and coil we may expect an inductance variation in broadcast receivers of the order of 10 to 1, in short-wave receivers of the order of 4 to 1, and less than 2 to 1 in the v.h.f. bands." The problem of moulding a core so as to provide uniform properties along its length, and the use of dust cores in transmitter circuits are briefly considered.

621.396.662.34 : 621.396.611.21 **579**

Specially-Wide-Band Filters Using Cultivated Crystals.—W. Bantle, B. Matthias & P. Scherrer. (*Schweiz. Arch. angew. Wiss. Tech.*, June 1945, Vol. 11, No. 6, pp. 161–164.) By the use of piezoelectric crystals of mono-potassium or mono-ammonium phosphate it is possible to construct band-pass filters having a bandwidth of up to 33% of the mid-frequency, as compared with 13% for similar constructions using quartz. Also, the auxiliary inductances required are smaller than for quartz. This is due to the more favourable ratio of the effective series capacitance to the effective shunt capacitance in the equivalent electric circuit of such crystals. The use of various combinations of the two kinds of cultivated crystal also has possibilities outside the range covered by quartz alone.

621.396.665 **580**

Volume Expander Design.—R. W. Ehrlich. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 124–127.) An electronic expander in which the gain of a push-pull amplifier is controlled by a separate amplifier and rectifier. Full expansion is obtained in about ten milliseconds with a return to normal gain in one second. Control of the amount of expansion and of the time constant makes the unit applicable to practically all classes of programme material.

621.3.015.3 **581**

Simple Calculation of Electrical Transients [Book Review].—G. W. Carter. University Press, Cambridge, 120 pp., 8s. 6d. Macmillan, New York, $1.75. (*Elect. Engng, N.Y.*, Nov. 1945, Vol. 64, No. 11, p. 422.) ". . . an elementary treatment of transient problems by Heaviside's operational method in linear electrical circuits with lumped constants." See also 742 and 2830 of 1945.

621.392 : 621.3.015.33 **582**

Pulsed Linear Networks [Book Review].—E. Frank. McGraw-Hill, New York, 267 pp., $3.00. (*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 30, 68. Also *Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 222, 224.) ". . . for a first course in transient phenomena for college students." ". . . covers its field extremely well."

621.394./397].645.34 **583**

Network Analysis and Feedback Amplifier Design [Book Review].—H. W. Bode. D. Van Nostrand, New York, 1945, 551 pp., $7.50. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 508..510.) " Basic circuit theory and mathematical analysis of feedback amplifiers is presented in generalized form for the design engineer . . . The discussion is interspersed with practical circuit considerations and conclusions."

621.396.662.3 **584**

Einführung in die Theorie der Rundfunk-Siebschaltungen [Book Review].—R. Feldtkeller. S. Hirzel, Leipzig, 1940, 168 pp., RM 12. (*Akust. Z.*, July 1940, Vol. 5, No. 4, pp. 231–232.) " . . . an excellent text " for university students.

GENERAL PHYSICS

537.226 : 621.315.616 **585**

Synthetic Rubbers and Plastics — X. Electrical Properties : Theoretical Considerations in Relation to the Dipole Theory.—E. D. Humphries & A. W. Stannett. (*Distrib. Elect.*, Jan. 1946, Vol. 18, No. 161, pp. 71–75.) The variation of dielectric constant and loss factor with frequency and temperature is explained qualitatively in terms of the Debye theory of dispersion, and is illustrated by experimental results on polyvinyl chloride.

537.56 **586**

On the Formation of Small Ions, Large Ions and Neutral Centres.—G. Reboul. (*C.R. Acad. Sci., Paris*, 26th Feb. 1945, Vol. 220, No. 9, pp. 267–268.) A description of a mechanism to account for the observations noted in 3786 of 1945.

538.32 **587**

An Analysis of Electromagnetic Forces.—W. A. Tripp. (*Elect. Engng, N.Y.*, Oct. 1945, Vol. 64, No. 10, pp. 351–356.) The lack of evidence for the attraction between electrons in a cathode-ray beam suggests that the attraction between parallel conductors carrying current in the same direction is not due to attraction between the currents themselves, but to attraction between stationary " unneutralized " protons in one conductor and the moving electrons in the other. This leads to the general propositions that like charges in *relative* parallel motion repel each other, and that unlike charges in *relative* parallel motion attract each other. It is shown that the development of this point of view not only accounts satisfactorily for forces between neighbouring current-carrying conductors, but also for phenomena, such as the " pinch effect " in current-carrying molten metal, that are not explained satisfactorily in terms of the attraction between filaments of current. (But see 1413 of 1945.)

538.56 : 517.512.2 **588**

Fourier Transforms of Retarded and Advanced Potentials.—S. T. Ma. (*Phys. Rev.*, 1st/15th Oct. 1945, Vol. 68, Nos. 7/8, pp. 166–172.) " The Fourier transforms of the retarded and advanced potentials of the electromagnetic field and of the wave fields of elementary particles are obtained with the help of the invariant functions of Jordan, Pauli, and Dirac, together with their generalizations. It is shown that the Fourier transforms of these potentials are closely related to those of the outward and inward moving waves given by Dirac for the scattering problems in quantum mechanics, and their connection is discussed. It is also shown that there exists a type of potentials which represents waves with frequencies of opposite signs propagating in opposite directions."

538.561.029.6 **589**

The Production of Extremely Short Electromagnetic Waves.—J. P. Cooley & J. H. Rohrbaugh. (*Phys. Rev.*, 1st/15th May 1945, Vol. 67, Nos. 9/10, pp. 296–297.) " By using as electric dipole radiators many small, aluminum particles in a rapid, continuously flowing stream of oil, radiation measured to be between approximately 2.2 mm and 0.2 mm was produced. The necessary electric field was supplied by a shock excitation circuit generating 1 000 surges per second, which were applied to a 1 cm gap containing the oil-stream." Spectra produced by wire diffraction gratings were examined with thermopiles. The apparatus is briefly described.

535.22 **590**

The Velocity of Light [Book Review].—N. E. Dorsey. Trans. Amer. Phil. Soc., New Series, Vol. 34, Part 1, 1944, 110 pp., $2.50. (*Science*, 2nd Nov. 1945, Vol. 102, No. 2653, pp. 458–459.) A critical review of the experimental data. The author " has set a standard of rigorous and objective criticism . . ."

621.396.61 **591**

Théorie des Oscillateurs [Book Review].—Y. Rocard. Editions de la Revue Scientifique, Paris, 1941, 220 pp. (*Proc. phys. Soc.*, 1st Nov. 1945, Vol. 57, No. 324, pp. 587–588.) " On the whole a book which the physicist with a taste for elementary mathematics would do well to buy."

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

061.6 : 550.38 **592**

Summary of the Year's Work, to June 30, 1945, Department of Terrestrial Magnetism, Carnegie Institution of Washington.—J. A. Fleming. (*Terr. Magn. atmos. Elect.*, Dec. 1945, Vol. 50, No. 4, pp. 279–286.)

523.165 **593**

The Geophysical Aspect of Cosmic Rays [Twenty-ninth Guthrie Lecture].—A. Duperier. (*Proc. phys. Soc.*, 1st Nov. 1945, Vol. 57, No. 324, pp. 464–477.) The results of a number of workers investigating the correlation of cosmic ray intensity and temperature of the earth or atmosphere, are discussed. Measurements of the diurnal variation of cosmic radiation can be accounted for by assuming a magnetic field at the surface of the sun sufficient to prevent particles of less than 2.10^9eV from reaching the earth. A marked 24 hour and a 12 hour periodicity has been observed. The most notable feature of the effect of magnetic storms is a decrease in cosmic ray intensity of world-wide nature.

523.746 + 550.38 **594**

Solar and Magnetic Data, July to September, 1945, Mount Wilson Observatory.—(*Terr. Magn. atmos, Elect.*, Dec. 1945, Vol. 50, No. 4, p. 313.)

523.746 **595**

Provisional Sunspot-Numbers for July to September, 1945.—W. Brunner. (*Terr. Magn. atmos. Elect.*, Dec. 1945, Vol. 50, No. 4, p. 319.)

550.38 **596**

A Preliminary Study of the Relation Between Geomagnetism and the Circulatory Motions of the Air in the Atmosphere.—O. R. Wulf. (*Terr. Magn. atmos. Elect.*, Dec. 1945, Vol. 50, No. 4, pp. 259–278.)

551.51.053.5 **597**

Scattering of Radio Waves from Great Virtual Distances.—L. Harang. (*Terr. Magn. atmos. Elect.*, Dec. 1945, Vol. 50, No. 4, pp. 287–296.) " Using a pulse-transmitter of high power, scattered reflections corresponding to virtual reflection-distances of 500 to 2 500 km have been obtained.

" The test-frequencies used (10–11 Mc/sec) were usually greater than the critical penetration-frequencies of the F_2-layer. Records on a fixed frequency over a number of days have been taken in order to study the diurnal variation and dependence on geomagnetic activity and aurora. Four different phases in the diurnal variation have been recorded. During the two day-phases it has been shown that the scattered reflections cannot come in vertically as they are not cut off by the *F*-layer.

" During the two night-phases the echoes are reflected from scattering areas lying in or near the zenith at heights of 500 to 800 km. Small geomagnetic disturbances increased the scattering at these heights. Stronger perturbations were accompanied by scattering from heights down to 100 to 200 km."

551.51.053.5 **598**

Note on Diffusion in the Ionosphere.—J. C. Jaeger. (*Proc. phys. Soc.*, 1st Nov. 1945, Vol. 57, No. 324, pp. 519–523.) The general equations of diffusion, recombination and ion production set up by Hulburt (*Phys. Rev.*, 1928, Vol. 31, p. 1018.) are quite insoluble. An exact solution is given for the special case of an atmosphere in which the particle density varies exponentially with height, and in which the effects of recombination and the earth's magnetic field are neglected. Numerical results are given for three special initial distributions of ion density.

551.51.053.5 : 523.78 **599**

Radio-Echo Observations at Tromsö During the Solar Eclipse on July 9, 1945.—L. Harang. (*Terr. Magn. atmos. Elect.*, Dec. 1945, Vol. 50, No. 4, pp. 307–310.) " The critical frequencies of the ionized layers were determined during the partial eclipse at Tromsö. The maximum obscuration was 92 per cent. For the F_1- and E_1-layers a symmetrical decrease and increase of the critical frequencies and the corresponding maximum electron-densities were observed during the eclipse. For the F_1-layer the maximum electron-concentration decreased from 3.47 to 1.48×10^5 electrons/cm^3, that is, by 57 per cent. For the *E*-layer the maximum electron-concentration decreased from 2.04 to 1.04×10^5 electrons/cm^3, that is, by 49 per cent. For the F_2-layer the commencement of the eclipse was followed by a sudden decrease in the ionization-curve, the latter having a minimum at about the time of maximum obscuration. But after the eclipse the previous conditions of the F_2-layer seem not to have been restored. From the observations it seems to be evident that the eclipse has an effect on the F_2-layer but that this effect is masked by vertical movements and the slower recombination-processes."

621.316.93 **600**

Lightning Investigations on 33-Kv Wood-Pole Lines.—Andrews & McCann. (*See* 760.)

621.396.91 : 551.509 **601**

[E layer] **" Controls " the Weather.** — (*Sci. News Lett., Wash.*, 17th Nov. 1945, Vol. 48, No. 20, p. 310.) Solar radiation appears to be connected both with the weather and with the thickness of the *E* layer of the ionosphere. *E*-layer measurements may therefore assist forecasting of temperature peaks and troughs a week ahead. Article duplicated in *Science*, 16th Nov. 1945, Vol. 102, No. 2655, Supplement p. 12.

LOCATION AND AIDS TO NAVIGATION

621.3(41) " 1939/1945 " **602**

British Electrical Engineers and the Second World War.—Dunsheath. (*See* 729.)

621.38 : 538.74 : 629.13 **603**

Flux Valve Aero Compass.—R. Lewis. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 93..126.) To overcome frequent manual resetting of the azimuth scale of an airborne gyro-compass, resetting is continuously performed by the amplified signals from a flux valve through a selsyn motor. The three horizontal " star " coils of the flux valve superimpose the pick-up from the earth's magnetic field on a 400 c/s exciting field.

621.396 : 629.13 **604**

Aviation Communication Systems.—D. W. Rentzel. (*Elect. Engng, N.Y.*, Nov. 1945, Vol. 64, No. 11, pp. 387–391.) An account of the progress that has been made in two-way communication, basic methods of navigation, and blind landing systems. The present and future frequency allocations over both long and short distances for these requirements are given. The problems of collision warning indicators, radio altimeters, air traffic control, and written communication to aircraft, which remain to be solved before air travel is safe and reliable, are closely analysed. The basic problems of voltage supply and weight and size of airborne equipment are discussed.

621.396.9 **605**

The Loran System – Part I.—D.G.F. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 94–99.) Description of the principles of " hyperbolic " navigation systems with particular reference to Loran. The system comprises two pairs of synchronized pulse transmitters operating on the same radio frequency within the band 1.7 to 2.0 Mc/s, each pair of transmitters having its own characteristic and accurately controlled pulse repetition frequency. At the receiving station (on board the craft which desires to fix its position) arrangements are made to measure the difference in the times of arrival of pulse-trains from the respective transmitters in each pair. By utilizing signals reflected from the *E* layer as well as ground-wave signals, and by suitably disposing the transmitters, useful ranges of up to 750 miles by day and 1 500 miles by night are obtained. Mention is made of the SS Loran system in which synchronization of the pulse repetition frequencies at the slave transmitters remote from the " double master station " is achieved by using the signals received at the " slaves " from the " master " ***via*** the *E* layer. For Part II see 606 below. See also 3916 of 1945 for an account of a similar system (Gee).

621.396.9 **606**

Loran Receiver-Indicator.—D.G.F. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 110–115.) Exact coincidence, to an accuracy of $1\ \mu$s, of the $40\ \mu$s pulses from the master and slave stations is accomplished by two expansions of the portion of the horizontal sweep upon which the pulses appear. By substituting a time scale for the pulses on each trace, the time difference is measured in units, tens, hundreds, and thousands of microseconds. Circuit diagrams and photographs of the presentation are given. The complete process can be carried out in less than one minute, and can be repeated for a second pair of stations working on the same r.f., but with a slightly different pulse repetition rate. For part I see 605 above.

621.396.9 **607**

New Aid to Navigation.—(*Electrician*, 30th Nov. 1945, Vol. 135, No. 3522, pp. 592–593.) A brief account of the Decca navigator system. See also 331 of February.

621.396.9 **608**

The SCR-584 Radar – Part I.—D.G.F. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 104–109.) Detailed description of an equipment used to control anti-aircraft fire, capable of tracking aircraft automatically at a range of 18 nautical miles and of detecting them at a range of 40 nautical miles. The wavelength used is between 10 and 11 cm, and a pulse length of $0.8\ \mu$s enables the target range to be indicated to an accuracy of ±25 yds, repeatable to ±2 yds. Helical scanning at 6 rpm is used for searching, and conical scanning at 1400 rpm for tracking, the angular accuracy of follow then being 0.06°. The equipment is normally trailer-mounted, and the 6ft-diameter paraboloid reflector used with the aerial can be retracted for transportation. For part II of this article see 609 below.

621.396.9 **609**

The SCR-584 Radar – Part II.—D.G.F. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 104–109.) The antenna feed system consists of coaxial transmission lines, the inner conductor supported by quarter-wave stubs. The rotating joints have quarter-wave overlaps between inner and outer conductors with a small gap forming a capacitance path for the r.f. energy while allowing free rotation of the joint about the line axis. To enable the same antenna to be used for the transmitter and for the receiver, a low pressure gas discharge tube (TR cell) is inserted in the feed to the receiver. This tube has two conical electrodes forming part of a resonant cavity which can be tuned to the transmitter frequency. When the cavity is excited by the strong transmitted pulse a high potential appears across the electrodes, sufficient to break down the gap and short-circuit and de-tune the cavity. The transmitter pulse is thus made harmless to the receiver. After the end of the transmitted pulse the gap de-ionizes in about $1\ \mu$s and the weaker echo signals are coupled through the TR cavity to a silicon crystal mixer, with a reflex klystron as the local oscillator. The 30 Mc/s i.f. signal passes to two preamplifier stages mounted adjacent to the crystal, then to the i.f. stages in the receiver proper where, after the fifth stage, the i.f. channel divides into two. The servo channel, operating through a narrow gate, feeds the auto-tracking circuits, and the range channel feeds the indicators. For Part I see 608 above.

621.396.9 **610**

Fire-Control Radar MPG-1.—H. A. Straus, L. J. Rueger, C. A. Wert, S. J. Reisman, M. Taylor, R. J. Davis & J. H. Taylor. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 92–97.) A 3 cm wavelength radar unit, housed in a water-tight trailer van, to give tracking of small fast targets with sufficient resolution and accuracy for use in directing the fire of heavy calibre coastal defence batteries, and capable of being operated within a few hours of the selection of a site. A 35 kW pulse, $1\ \mu$s wide for the PPI (searching), and $1/4\ \mu$s for the tracking B-scope, is obtained from a magnetron oscillator. The r.f. energy is fed to the antenna system through four waveguide arms in the rotating feed assembly. For PPI, one of the feed arms is fixed in the centre of the antenna throat and energy is radiated along the antenna axis. For the B-scope, the feed assembly rotates at 4 revolutions per second across the antenna throat, causing the beam to sweep 16 times per second across a 10° sector centred on the antenna axis, which is itself adjustable between 0°–360° with either presentation. The receiver system contains a duplexer with TR and anti-TR switch valves, to enable the same antenna to be used for transmitter and receiver, a klystron local oscillator with automatic frequency control to compensate for drift of transmitter frequency, a 30 Mc/s i.f. amplifier with 10 Mc/s bandwidth, and a video output amplifier feeding the oscilloscopes. A 163.88 kc/s crystal oscillator is used for the synchronization system and to derive the range markers. Maximum accuracy when tracking, 20 yds and 0.5° azimuth, at a maximum range of 28 000 yds. Searching range 80 000 yds with reduced accuracy.

621.396.9 **611**

Radar in A.A. Defence.—H. G. Foster. (*Electronic Engng*, Jan. 1946, Vol. 18, No. 215, pp. 2–8.) A description of a G.L. Mk. II radar set giving slant range, elevation and azimuth. Operating frequency between 55 and 85 Mc/s. The receiver uses separate aerials and cathode-ray tubes for range, elevation, and bearing; aerials and display are switched by a synchronous motor to a single receiver channel. Outputs from two bearing aerials are opposed, and the resultant alternately added to and subtracted from the range-aerial output, giving two equal pips on the screen when on target. Elevation is determined by comparing the outputs, with a goniometer, from two dipoles λ and $3\lambda/2$ above the ground. Range 2 000–14 000 yds, accuracy ± 25 yds, bearing and elevation accuracy ± 1°.

A Command Post is described, and tactics used in engaging aircraft are described in relation to the limitations of Mk. II equipment.

A brief description is given of G.L. Mk. III, using centrimetric aerial systems in paraboloid reflectors. Range 36 000 yds, accuracy ± 25 yds, bearing and elevation accuracy ± 10′.

621.396.9 **612**

Radar Specifications.—D. G. F. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 116–119.) Specifications of radar equipment require details of the type of pulse, of the radiator, and of the scanning mechanism. Maximum range of detection is determined from pulse and radiator specifications as indicated by the radar equation, which is given (see also 2879 of 1945). Angular accuracy is determined by the radiator specification, and range accuracy by the pulse specification.

The considerations which determine the type and rate of scanning are discussed, and the different types of presentation are listed. A table is given of the specifications of U.S. Signal Corps radar sets working on frequencies from 110 to 10 000 Mc/s, numbered SCR-268, 270, 516, 545, 547, 582/682, 584/784 and AN/TPS-3, AN/TPL-1, AN/MPG-1.

621.396.9 **613**

Shipborne Radar.—G. E. M. Bertram. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 52–56.) A general description, with illustrations, of an SO (Raytheon) radar. Pulse input 250 kW, 1 μs pulses at 400 c/s repetition; receiver uses PPI display. Expected maximum range of commercial model 15–20 miles on ship targets, 4–6 miles for *e.g.* bell-buoys. For another account see *Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 98..130.

621.396.9 **614**

U.S. Carrier Radar.—E. A. Witten. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 162, 196.) A general description of the radio communications and radar equipment on U.S.S. Lake Champlain.

621.396.9 **615**

The Evolution of Radar.—(*Engineering, Lond.*, 24th Aug.–12th Oct. 1945, Vol. 160, Nos. 4154–4161, pp. 154..285.) An eight-part historical account of the main war-time applications.

621.396.9 **616**

Radar Indicators.—E. E. Skinner. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 95..133.) Descriptions of c.r. tube displays used in radar, including the plan position indicator and sector scanning in detail.

621.396.9 : 534.321.9 **617**

Acoustic Control in the Flight of Bats.—D. W. Ewer: H. Hartridge: M. Wilkinson. (*Nature, Lond.*, 8th Dec. 1945, Vol. 156, No. 3971, pp. 692–693.) Correspondence following 258 of February (Hartridge).

621.396.9 : 551.515.43 **618**

Records of Storms with Radar Equipment.—(*Science*, 26th Oct. 1945, Vol. 102, No. 2652, Supplement p.14.) A brief report of the use of microwave radar for the location of storms. The waves are reflected by the rain associated with the storms.

621.396.9 : 623.26 **619**

Mine Detector.—H. Chireix. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 128..194.) The change in self-inductance of a search-coil caused by the proximity of metal alters the phase relation between two voltages applied to a special bridge circuit. This change actuates a relay which in turn operates visual and aural indicators. Summary of U.S. patent 2 376 659.

621.396.932[/.933].25 **620**

Radio Marker Buoy.—(*Electrician*, 11th Jan. 1946, Vol. 136, No. 3528, p. 108.) Brief details of the "jelly fish" radio responder buoy.

621.396.932[/.933].25 **621**

"Racon" May Guide Ships Safely Through Dense Fog.—(*Sci. News Lett., Wash.*, 24th Nov. 1945, Vol. 48, No. 21, p. 327.) A radar transmitter on the ship interrogates an electronic beacon on shore, which responds automatically. The coded response identifies the beacon; the range and direction given by the radar determine the relative position. Brief note only. See also 620.

621.396.933.23 **622**

Ground-Controlled Approach for Aircraft.—C. W. Watson. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 112–115.) Two ground-based radars are used to assist aircraft in landing in conditions of poor visibility. The search radar with a plan-position indicator guides the aircraft from a range of 30 miles into a position ready for a landing glide. This radar, working at a super-high frequency uses a stacked dipole array with a parabolic reflector giving a beam 6° wide in azimuth. The landing-glide is controlled by the use of a higher-frequency higher-precision radar with a range of 10 miles. This has two beams given by separate aerial systems. The azimuth beam is 1.5° high and 0.6° wide and sweeps a volume 1.5° high and 20° wide; the elevation beam is 3° wide and 0.4° high and sweeps a volume 3° wide and 7° high. The position of the aircraft relative to a correct approach is relayed to the aircraft.

623.454.25 : 621.396.9 **623**

Proximity Fuze.—F. R. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 110–111.) An oscillator feeds an aerial, which may be the missile itself or a small dipole. Energy reradiated from the target is picked up on the aerial and changes its impedance, this change being used to detonate the projectile Power supply is obtained from a battery, supplied with acid through the acceleration produced during projection, or from a small wind-driven generator in the nose of the projectile. For an equivalent explanation of the mechanism in terms of Doppler effect see 89 of January and 625 below.

623.454.25 : 621.396.9 **624**

Generator-Powered Proximity Fuze.—R. D. Huntoon & B. J. Miller. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 98–103.) A detailed description of mechanism and design features. Developed for use with rocket projectiles, the fuse contains a c.w. oscillator tightly coupled to the antenna, which is the rocket itself. Reflections received from the target in varying phase relative to the oscillator effectively cause a cyclic fluctuation of aerial input impedance, so causing the oscillator to beat. This is equivalent to beats between the oscillator and the received signal assuming Doppler effect (*c.f.* 89 of January and 625 below). The beat falls in frequency and rises in amplitude as the rocket approaches its minimum distance from the target. The detonation occurs when the frequency and amplitude of the beat are within prescribed limits. The beat-frequency signal is selected and passed to an amplifier with regenerative feedback at the triggering frequency, high degenerative feedback at higher frequencies, and no feedback at lower frequencies. The amplifier characteristic and aerial directivity give a sharply defined detonation region. When the amplifier output reaches a critical value it fires a thyratron which triggers the explosion. A wind vane in the nose of the rocket drives a generator which, with a voltage regulator and selenium bridge rectifier, provides the h.t. and bias supplies. Raw a.c. is used for the filaments.

623.454.25 : 621.396.9 **625**

The Radio Proximity Fuze.—R. G. Peters. (*Communications*, Oct. 1945, Vol. 25, No. 10, pp. 45..94.) Description of the operation of the fuses in terms of the Doppler principle and also in terms of the principle of changing aerial impedance.

623.454.25 : 621.396.9 **626**

The Proximity Fuse.—(*Radio News*, Dec. 1945, Vol. 34, No. 6, pp. 51..157.) **Radio Fuze Fires Shells.**—(*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 160..201.) **Navy Proximity Fuse.**—(*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 104..136.) General descriptions.

629.13 : 621.396.9 **627**

VHF for Safe Landing.—(*Sci. News Lett., Wash.*, 1st Sept. 1945, Vol. 48, No. 9, pp. 131–132.) Description of some of the work of the Civil Aeronautics Administration in U.S.A. on the development of aids to air navigation with particular reference to use of v.h.f. radio apparatus for blind approach and landing. No technical details are given.

629.13 : 621.396.9 **628**

Funknavigation in der Luftfahrt [Book Review].—P. von Handel & K. Krüger. Friedr. Vieweg & Sohn, Brunswick, 1944, 108 pp., RM 4.50. (*Z. Ver. dtsch. Ing.*, 5th Aug. 1944, Vol. 88, Nos. 31/32, pp. 431–432.) " A comprehensive and exhaustive account of the principles and practice . . . "

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788.7 **629**

Manometer Circuit.—C. J. Calbick. (*Electronic Industr.*, Oct. 1945, Vol 4, No. 10, p. 198.) Alternating voltages are used to prevent errors due to leakage between anode and grid of ionization gauges. The leakage current, being a.c., is not recorded on the d.c. meters. Summary of U.S. patent 2 375 280.

533.56 **630**

High-Vacuum Pumping.—(*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 77..142.) Eimac HV-1 oil diffusion pump gives an ultimate vacuum of 4.10^{-7} mm of mercury, if every possible source of contamination is removed from the high vacuum system and a special oil of low vapour pressure is used. Maximum speed 33 or 72 L/sec at 10^{-5} mm according to whether a baffle is or is not used. Neoprene is recommended in place of rubber for gasket material.

621.315.229 **631**

Jacketing Materials for H-F Transmission Lines.—A. J. Warner. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 38–40, 87.) Suitable materials must (1) flex at – 40°C, (2) withstand 80°C for long periods and 120°C for short periods without deformation, (3) prevent cable deterioration on immersion in fresh or salt water, (4) withstand petrol, hot lubricating oils and hydraulic brake fluids, (5) have toughness and abrasion resistance, (6) not corrode copper, (7) have no adverse effect on the primary dielectric. Long life and good flame resistance are desirable properties.

Most materials used are deficient in some of these properties. Polyvinyl chloride and polyvinyl chloracetate are now most used. Improved plasticizers which do not contaminate the primary dielectric are described.

621.315.612 + 621.315.616 **632**

Radio Insulating Materials : Part 3.—A. H. Postle. (*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 42..70.) The principal electrical and mechanical differences between plastics and ceramics are explained by simple structure theory. Ceramics are classified by their thermal behaviour and chemical nature.

621.315.612.4 **633**

High Permittivity Crystalline Aggregates.—W. Jackson & W. Reddish. (*Nature, Lond.*, 15th Dec. 1945, Vol. 156, No. 3972, p. 717.) Wul's results (347 of February) are characteristic of a range of materials. A graph shows the temperature of peak permittivity for $BaTiO_3$-$SrTiO_3$ solid solutions of various compositions. Peak permittivities of the order of 10 000 have been observed.

621.315.613.1 : [621.317.372 + 621.317.333 **634**

Judging Mica Quality Electrically.—K. G. Coutlee. (*Trans. Amer. Inst. elect. Engrs*, Vol. 64, No. 11, pp. 735–740.) To overcome the uncertainties of the visual quality-classification of natural ruby mica, methods have been devised to test the two electrical properties required for capacitors, namely dielectric loss and dielectric strength. For the former a *Q*-meter is used, comprising a circuit resonant at 1 Mc/s which incorporates test electrodes between which the sample is inserted. The change in capacitance on insertion is corrected by a vernier capacitor which gives a direct classification, on a suitably calibrated meter, according to the *Q* of the specimen. A high-voltage spark test set is used to locate semi-conducting areas, pinholes and cracks. An account is included of tests on finished capacitors made with mica so classified. The tests are found to be satisfactory for testing block mica in accordance with ASTM specification D-748-45T.

621.315.613.1 : 621.319.4 **635**

Manufacture of Silvered Mica Capacitors.—Chapman. (*See* 755.)

621.315.615 : 621.319.4 : 621.365.5 **636**

Capacitors for High-Frequency Induction-Heating Circuits.—F. M. Clark & M. E. Scoville. (*Trans. Amer. Inst. elect. Engrs*, Vol. 64, No. 11, pp. 791–796.) A description of the development of a new type of organic liquid " Lectronol " dielectric for use in water-cooled, hermetically sealed capacitors, suitable for tank circuits of electronic induction heaters. A comparison of the properties of this dielectric with other commercial dielectric liquids shows superiority in capacity per unit volume and instability under severe conditions.

621.315.616 : 537.226 **637**

Synthetic Rubbers and Plastics – X. Electrical Properties : Theoretical Considerations in Relation to the Dipole Theory.—Humphries & Stannett. (*See* 585.)

621.315.616.9 **638**

Discussion on "The Development of Polythene as a High-Frequency Dielectric."—W. Jackson & J. S. A. Forsyth. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 295–297.) Discussion on 2768 of 1945.

621.315.616.9 **639**

Structure and Orientation in Thin Films of Polythene.—A. Charlesby. (*Proc. phys. Soc.*, 1st Nov. 1945, Vol. 57, No. 324, pp. 496–509.)

621.315.616.9 **640**

Effect of Temperature on the Structure of Highly Polymerized Hydrocarbons.—A. Charlesby. (*Proc. phys. Soc.*, 1st Nov. 1945, Vol. 57, No. 324, pp. 510–518.) The structure of polyethylene over a range of temperature from that of liquid oxygen to above the melting point, has been examined in the electron diffraction camera. As the temperature is raised there is a tendency to form a pseudo-hexagonal structure, but a change from crystalline to an amorphous form sets in at a temperature lower than the accepted melting point.

621.315.617.3 **641**

Insulation Materials.—(*Electrician*, 14th Dec. 1945, Vol. 135, No. 3524, p. 672.) Report of I.E.E. Radio Section discussion on "Film-Forming Materials used in Insulation" led by C. R. Pye. For another account see 352 of February.

621.318.22 + 621.318.322 **642**

Magnetic Materials.—L. Bragg. (*J. Instn elect. Engrs*, Part I, Dec. 1945, Vol. 92, No. 60, pp. 444–451.) An account of the development of magnetic theory is given, leading up to the modern conception of electrons as elementary magnets, in which ferromagnetism arises from unbalanced electron shells. Magnetization proceeds in three stages :– (1) domain boundary displacement (reversible) ; (2) sudden change-over of domains into the "easy" direction of magnetization nearest that of the applied field ; (3) slow change from easy direction to that of the field.

Fundamental atomic properties which cannot be changed are saturation, remanence, and Curie point ; initial permeability, coercivity, and hysteresis loss can be improved considerably by use of modern alloys and appropriate heat treatment. For transformer sheet steel, suitable rolling and annealing assists correct crystal alignment for small hysteresis loss.

621.318.32 : 621.318.42 **643**

Ferroinductance as a Variable Electric-Circuit Element.—J. D. Ryder. (*Trans. Amer. Inst. elect. Engrs*, Oct. 1945, Vol. 64, No. 10, pp. 671–678.) An expression involving the gudermannian is claimed to be superior to previous mathematical expressions for the B-H curve for a ferro-magnetic. The expression $B = B_n gd \frac{aNi}{l} + \frac{cNi}{l}$, where B_n, a, and c are constants, when adjusted to fit the B-H curve of a ferromagnetic at three points, gives reasonable agreement with experiment at all values. The expression is used to compute the inductance, effective resistance, reactance, and resonance of ferroinductances, and the results are compared with experiment. The expression indicates maximum permeability when $B = 0$, and is consequently in error at low values of B.

621.318.322.029.5 **644**

Radio Frequency Cores of High Permeability.—H. Beller & G. O. Altmann. (*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 86..154.) The cores are designed for coils required to have a high magnetic flux as well as a reasonably low loss. A special grade of carbonyl iron powder is used and cores with permeabilities of 40 to 70 can be produced. The permeability increases with packing factor of the particles and depends also on the manner of packing. The properties of three toroidal coils made from the new material are investigated.

621.318.322.029.54/.64 **645**

The Permeability of Ferromagnetic Materials at Frequencies between 10^5 and 10^{10} c/s.—J. T. Allanson. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 247–255.) A survey of theories and of methods of measurement and results. Indirect measurements by the following methods are described : (1) transmission line, (2) resonant circuit, (3) impedance bridge, (4) thermojunction, (5) wire grating. Factors bearing on the results, such as the strength of h.f. and d.c. fields, chemical composition, size and temperature of the specimen are discussed. Explanatory theories for the decrease of permeability with increase of frequency are described, and that of Becker (1719 of 1939), depending on eddy-current braking of domain changes is considered a satisfactory explanation of observed results.

621.318.323.2 : 621.396.662.2 **646**

Effective Permeability of High Frequency Iron Cores.—W. J. Polydoroff & A. J. Klapperich. (*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 38..71.) The effective permeability of the cores and the Q of the inductors made with them depend on basic magnetic properties and physical dimensions. True permeability was measured at 1 kc/s by the toroidal ring method, and the effective permeability of cylindrical slugs was measured by observing the difference in inductance of coils with and without the slugs in place. Curves are given showing effective permeability with core-length = coil-length *versus* true permeability for length/diameter ratios from 0.2 to 8.0. An empirical formula connects these effective values with effective values for different coil lengths.

621.357 : 621.38 **647**

Electro-Chemical Processes in the Manufacture of Electronic Devices.—A. Korbelak. (*Beama J.*, Dec. 1945, Vol. 52, No. 102, pp. 424–428.) Abridgement of a paper presented to the Electro-Chemical Society, New York. The deposition of 17 different metals, the electrostatic deposition of various non-metals, electrolytic cleaning, and electro-polishing are discussed.

621.357.9 **648**

Improvement in the Electrolytic Polishing of Aluminium and its Alloys.—P.-A. Jacquet. (*Génie civ.*, 1st June 1944, Vol. 121, No. 11, p. 92.) Short abstract of a paper in *Métaux, Corrosion, Usure*, Nov. 1943. The process can be applied to surfaces up to about 100 cm² in area with voltages of 25–50V, and is applicable to very pure aluminium, and to the most important alloys with copper and magnesium. The compositions of the electrolytes and conditions of working are given in the original paper.

621.385.832 **649**

"Characteristics of Luminescent Materials for Cathode-Ray Tubes."—(*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 299–300.) I.E.E. Radio Section discussion led by C. G. A. Hill, dealing with the emission spectra, phosphorescence, efficiency, secondary emission, mechanical properties and stability of materials as determined by their physical and chemical properties and by the conditions of operation.

621.396.69 **650**

One Facet of Naval Electrical Research.—E. F. Seaman. (*Elect. Engng, N.Y.*, Oct. 1945, Vol. 64, No. 10, pp. 358–362.) "That concerned with the adaptation of shipboard equipment to wartime conditions." Items include fungus, jewel vibration, mica, magnet wire, and various tests.

621.791.352 : 621.385 **651**

Brazing Operations in Transmitter Tube Assembly.—(*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 340–364.) Contains, *inter alia*, a description of a ceramic-lined burner so arranged that the electrode assembly is untouched by the flame during processing.

679.5 + 621.315.616.9 **652**

Notes on Plastics.—J. Taylor. (*Electrician*, 30th Nov. 1945, Vol. 135, No. 3522, pp. 595–596.) Properties and uses of methyl methacrylate and polythene.

679.5 **653**

Plastic Materials.—J. Taylor. (*Electrician*, 14th Dec. 1945, Vol. 135, No. 3524, pp. 675–676.) Properties and uses of polectron (a polymer of vinyl carbazole), polyvinyl alcohol, polyamide moulding materials, and nylon.

533.5 + 531.788 **654**

High Vacuum Technique [Book Review].—J. Yarwood. Chapman & Hall, London, 2nd edn. 1945, 140 pp., 12s. 6d. (*Electrician*, 30th Nov. 1945, Vol. 135, No. 3522, p. 617.) "The author . . . has included many new sections, but generally preserves the previous condensed treatment." See also 3996 of 1945.

MATHEMATICS

512.942 **655**

Vector Analysis.—H. G. Shea. (*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 94–97.) "Review of vector mathematics including divergence and curl for engineers dealing with wave guides and radiation."

517.512.2 : 518.5 : 621.383 **656**

A Photo-Electric Fourier Transformer.—M. Born, R. Fürth & R. W. Pringle. (*Nature, Lond.*, 22nd Dec. 1945, Vol. 156, No. 3973, pp. 756–757.) Note on an instrument for producing a graph of $g'(y) = \int_a^b f(x)\cos(yx + \delta)dx$ on the screen of a c.r. tube from a mask cut out of black paper in the shape of the graph of $f(x)$ or from a photographic record of the function in density variation.

517.512.2 : 538.56 **657**

Fourier Transforms of Retarded and Advanced Potentials.—Ma. (*See* 588.)

518.61 **658**

Calculation of the Magnetic Field in Dynamo-Electric Machines by Southwell's Relaxation Method.—H. Motz & W. D. Worthy. (*J. Instn elect. Engrs*, Part II, Dec. 1945, Vol. 92, No. 30, pp. 522–528.) An explanation and example of the numerical solution of Laplace's equation with assigned boundary conditions, using the relaxation method.

519.283 **659**

Statistical Methods in Quality Control I-VI.—A.I.E.E. Sub-committee on Educational Activities. (*See* 805).

621.392 **660**

The Capacity of Twin Cable.—J. W. Craggs & C. J. Tranter. (*Quart. appl. Math.*, Oct. 1945, Vol. 3, No. 3, pp. 268–272.) A solution of Laplace's equation for the case of two long parallel cylindrical conductors, each surrounded by a coaxial sheath of dielectric, the boundaries of the two dielectric cylinders touching.

A conformal transformation and Fourier's integral theorem are applied to the result, and a quantity is derived by means of a determinant, whence the capacity per unit length can be obtained. Methods of computation are discussed.

621.396.11 : 551.51.053.5 **661**

On the Propagation of Radio Waves.—Rydbeck. (*See* 709.)—Tables of useful cylinder functions of order $\pm 1/3$ and $\pm 2/3$ are given with interval 0.02 from $x = 0$ to 1, and interval 0.2 from $x = 0$ to 8.

51 : 5 + 51 : 6 **662**

Die Mathematik des Naturforschers und Ingenieurs – Vols. 3 & 4 [Book Review].—B. Baule. S. Hirzel, Leipzig, Vol. 3, 80 pp., RM 4.40, Vol. 4, 112 pp., RM 5. (*Z. Ver. dtsch. Ing.*, 8th July 1944, Vol. 88, Nos. 27/28, p. 380.) Analytical geometry, and ordinary differential equations. Part I noted in 4091 of 1945.

518.3 **663**

Alignment Charts: Construction and Use [Book Review].—M. Kraitchik. D. Van Nostrand, New York, 94 pp., $2.50. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, p. 199.) ". . . the basic theory of nomograms is built round determinants."

MEASUREMENTS AND TEST GEAR

531.765 : 621.317.755 **664**

The Exact Measurement of Short Time Intervals on a Cathode-Ray Tube.—W. Amrein & A. von Wattenwyl. (*Schweiz. Arch. angew. Wiss. Tech.*, Sept. 1945, Vol. 11, No. 9, pp. 257–262. In German.) A circular time-base of accurately known frequency is generated from crystal or tuning-fork-controlled circuits. The impulses, between which the time interval is to be measured, are applied to give brightness modulation of the trace, and the angular interval between the starting points of the bright streaks on the screen, measured on a photograph, give a measure of the time. To prevent the trace of the second impulse from overlapping that of the first on a later sweep of the time-base, the first impulse is made to trigger a saw-tooth discharge circuit, coupled to the post-accelerator of the tube so as to change slightly the diameter of the time-base circle for the second impulse. In an example quoted, an interval of 2 ms between impulses was measured to 2 μs. The time-base frequency was 10 kc/s, so that 20 sweeps were made between the starting points of the two traces, and a displacement of 7° corresponded to 2μs interval.

There are errors due to ellipticity and phase irregularities of the time-base. It is relatively easy to keep the first sufficiently small. An error of 2–3° in location of the deflector plates is common in most c.r. tubes, and there can also be phase errors due to stray capacitances, etc., in the phase-shift circuit for producing the time-base, and due to harmonics of the deflecting voltages. Errors due to the last two causes can be minimized by the choice of circuit values, by the use of high-Q circuits, and by taking care not to overload the amplifiers. The accuracy of the time-base can be checked by measuring the angular displacement between the bright traces caused by brightness modulation at a frequency which is an exact multiple of the time-base frequency. A total residual error of the order of 3–4° can be expected in the position of the trace, its relative importance depends on the number of sweeps of the time-base during the interval to be measured.

534.62 **665**

A Method for Obtaining Small Mechanical Vibrations of Known Amplitude.—Smith. (*See* 522.)

621.315.212 : 621.317.341.029.58/.62 **666**

The S-Function Method of Measuring Attenuation of Coaxial Radio-Frequency Cable.—C. Stewart, Jr. (*Trans. Amer. Inst. elect. Engrs*, Sept. 1945, Vol. 64, No. 9, pp. 616–619.) The Q-factor and input reactance of a short-circuited length of cable are measured on a commercial Q-meter. The S-factor, which is a function of the characteristic impedance (assumed to be known) and the measured input reactance of the short-circuited sample, is taken from a graph. The attenuation constant of the cable is S/Qd db/100 ft, where d is the length of the sample in feet. The accuracy of the result is not critically dependent on the accuracy of the value assumed for the characteristic impedance. The usefulness of the method is limited to the range 1-100 Mc/s.

621.315.213.12 : 621.317.3.029.58/.62 **667**

Apparatus for Measurements on Balanced-Pair High-Frequency Cables in the Range 10–200 Mc/s.—J. C. Simmonds. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 282–286.) The apparatus described earlier (3322 of 1945) for use up to 10 Mc/s is extended to 200 Mc/s by replacing the variable capacitor by a short-circuited transmission line of variable length, and the diode resistor by a thermistor. The transmission line reactance is taken as $Z_0\tan(\omega l/v)$ with $v = 3.10^{10}$ cm/sec. Measurements at 200 Mc/s showed that for a thermistor whose d.c. resistance is less than 10 000 Ω the difference between the h.f. and d.c. values is not greater than ±3%.

The measurement of reactance, resistance, or impedance is made by substitution; characteristic impedance, attenuation, and phase velocity are also readily determined, and typical measurements on a balanced cable are given. Measurements on $\frac{1}{2}$ W solid-carbon-type resistors are shown graphically, and are in close agreement with Howe's theory.

The accuracy of the apparatus is estimated at ±3% for reactance and ±2% for resistance if the thermistor resistance is not too high. The error in phase velocity measurement should not exceed ±1%.

621.315.613.1 : [621.317.372 + 621.317.333 **668**

Judging Mica Quality Electrically.—Coutlee. (*See* 634.)

621.317.331 : 621.3.015.33 **669**

Resistance Measurement at High Impulse Voltages.—S. L. Shive. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 158–159.) A condenser is discharged through the primary of a suitable step-up transformer, and the damped train so produced is applied across a Wheatstone bridge composed of resistors with zero voltage coefficient. Two cathode-ray tubes are used as null-point indicator and voltmeter respectively. It is found that composition-type resistors have a negative voltage coefficient of resistance: the importance of this property in the design of suppressor circuits for ignition systems is considered.

621.317.335 **670**

Capacitance Measurement in Multi-Electrode Systems.—W. Pritchett. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 66–68.) A parallel substitution method developed for measuring neutralizing and other small value capacitors, which is most useful in the range 1–100 $\mu\mu$F.

621.317.372 : 621.317.755 **671**

Cathode-Ray Q Meter.—R. Feldt. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 462..470.) The component under test is excited by means of short pulses synchronized with the sweep frequency. The resulting damped oscillations are taken to the vertical deflection plates, or associated amplifier. The Q, or the decrement of the circuit, may be measured directly by means of a suitably engraved transparent scale fitted to the screen. Reprinted from *DuMont Oscillographer*, Mar./Apr. 1945.

621.317.715.025 **672**

A-C Galvanometer.—A. L. Quirk & H. D. Hall. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 147–149.) An amplifier used in conjunction with a variable self-biased 6E5 electron-ray valve provides a null-point indicator for a.c. bridges that is electrically and mechanically strong, free from vibration troubles, and insensitive to stray fields. The minimum signal that can be detected is 20 μV.

621.317.72 + 621.314.2] : 621.362 **673**

A.C. Amplifier and Voltmeter.—L. C. Roess. (*See* 558.)

621.317.72 : 621.385 : 541.132.3 **674**

pH Meter.—C. Dorsman. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 194..198.) A circuit for the measurement of a small d.c. voltage across a source of high internal impedance. The difference between this voltage and a known adjustable voltage is converted into a.c. and, on amplification, is applied to a cathode-ray indicator. Summary of U.S. patent 2 372 062.

621.317.72.084 **675**

Notes on Zero-Suppressed A.C. Voltmeters.—L. Medina. (*Proc. Instn Radio Engrs, Aust.*, Sept. 1945, Vol. 6, No. 3, pp. 11–16.) Limited demand causes mechanical means of zero suppression, which involve special tooling, to be uneconomic in Australia. Of a number of electrical zero-suppressing circuits investigated and described the best, used for an a.c. voltmeter, has a parallel resonant circuit in series with the instrument. A 20Ω 100 mA moving-iron instrument is connected in series with a resistance of 480 Ω and with a capacitor of 1 μF. The capacitor is in parallel with an iron-cored reactor so that the combination is in resonance when 220 V are applied to the whole circuit. Increase of voltage causes a disproportionately great increase of current through the instrument due to change of inductance with current. The scale is nearly linear over the range 220 to 260 V, which occupies more than half the full length of the scale. The circuit is only suitable for a fixed frequency, and is subject to wave-form error.

621.317.73.029.54/.58 **676**

A Radio-Frequency Capacitance and Conductance Bridge.—R. F. Proctor & E. G. James. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 287–290.) A bridged-T network suitable for measurement of partial capacitances and conductances, which operates at 1 Mc/s but can be used up to 50 Mc/s if the usual precautions for residuals are taken. The design, construction, and theory of the bridge are given, and the method of calibrating for conductance is described. Capacitances of 0–28 $\mu\mu$F and conductances of 0–11 μmho can be measured with balancing accuracies of 0.02 $\mu\mu$F and 0.05 μmho respectively. A correction to the capacitance reading, which is a function of the measured conductance, is required.

621.317.73.029.62 **677**

Bridge Method of Measurement at Ultra High Frequencies.—S. Datta. (*Electrotechnics*, Sept. 1945, Nos. 17/18, pp. 85–95.) A modified form of Schering bridge is used at frequencies up to 45 Mc/s for the measurement of capacitance and power factor. The corrections to be applied for residual inductance of the resistors are considerable.

621.317.735 **678**

Industrial [insulation] **Testing with High Voltage.**—(*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 106–108.) Equipment for testing insulation in aircraft. Portable model operates off 110 V 60 c/s, and tests 10–10 000 MΩ at any voltage between 2 000–15 000 V d.c. Other models test at voltages up to 200 000 V d.c.

621.317.761.029.62/.64 **679**

The Measurement of Frequencies in the Range 100 Mc/s to 10 000 Mc/s.—L. Essen & A. C. Gordon-Smith. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 291–295.) Description of a small portable apparatus for frequency measurement by the interpolation method. A quartz oscillator provides a standard frequency of 1 Mc/s and controls multivibrators at 100 kc/s and 10 kc/s. Two oscillating detectors with respective ranges of 300–600 Mc/s and 15–20 Mc/s enable the unknown frequency to be suitably divided by the observation of audible beats and compared with the standard frequency. The accuracy is estimated at ± 1 part in 10^6 if the measurement is made rapidly to reduce the effect of drift of the detector oscillators.

621.317.784 : 621.385 **680**

Electronic Wattmeter.—L. R. Malling. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 133–135.) In early designs of electronic wattmeters, voltages corresponding to the voltage and current supplied to the load were fed to the wattmeter through transformers. In later models the frequency range has been increased by the substitution of cathode followers for the transformers. The circuit includes push-pull pentode rectifiers that should be well balanced against each other and have accurately parabolic characteristics. Input power is indicated on a d.c. meter with a linear scale.

621.395.61/.62] : 621.317.39 **681**

Curve-Tracer for Acoustic Devices.—Hellmann. (*See* 527.)

621.396.611.21 **682**

Crystal Oscillator Theory.—(*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 16..25.) Summary and discussion of 3324 of 1945 (Fair).

621.396.611.21 **683**

Practical Problems of [piezoelectric] **Crystal Dimensioning.** — C. W. Franklin. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 96..158.) A finished crystal has one dimension which is thought of as governing its frequency. Changes in other dimensions may however alter the frequency. The frequency and amplitude of vibration are affected by wetness, unequal pressure, or if the air-gap resonates and damps the vibration. Graphs show variations of frequency with different conditions.

621.396.611.21 **684**

Shear Modes in Piezo-Electric Crystals.—S. Bhagavantam & D. Suryanarayana. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, p. 202.) Reprint of 1875 of 1945.

621.396.611.21 : 549.514.1 **685**

Aging of Quartz Crystals.—S. X. Shore. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 70..77.) The surface of a crystal prepared by abrasion is stressed and slowly breaks down; consequently the frequency of the crystal increases with age. This process can be hastened by artificial ageing by a series of heat cycles. Ageing can be avoided by using etching instead of abrasion for the final process of manufacture. For an 8 Mc/s crystal, preparation by abrasion was stopped when the frequency was 10 kc/s below the required value, and final adjustment was made by etching in ammonium bifluoride solution. Part 4 of a series, for previous parts see 3826 of 1945, 170 of January, and 573 above.

621.396.615 **686**

Notes on the Stability of LC Oscillators.—Lea. (*See* 569.)

621.396.67 **687**

Artificial Antenna.—Wald. (*See* 553.)

621.396.933.083.7 : 629.13 **688**

Plane-to-Ground Radio Telemetering.—Moore. (*See* 701.)

621.317.715 + 621.317.75 **689**

Galvanómetros y Oscilógrafos [Book Review].—S. Gerszonowicz. G. E. Stechert (distributor), New York, 1943, 392 pp., \$6.00. (*Beama J.*, Dec. 1945, Vol. 52, No. 102, p. 419.) "... a very real contribution to the technical literature on galvanometers."

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

518.5 : 621.383 **690**

A Photo-Electric Fourier Transformer.—Born, Fürth & Pringle. (*See* 656.)

541.132.3 : 621.317.72 : 621.385 **691**

pH Meter.—C. Dorsman. (*See* 674.)

551.509 : 621.396.91 **692**

[E layer] **" Controls " the Weather.**—(*See* 601.)

551.515.43 : 621.396.9 **693**

Records of Storms with Radar Equipment.—(*See* 618.)

621.317.39 : 539.37 : 621.395.645.33 **694**

Strain Analyzing and Recording Instruments.—C. M. Hathaway. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 74..190.) The operation of inductance-type and resistance-type strain gauges is described, as well as bridge circuits, amplifiers, and recording oscillographs used with them. Inductance-type gauges can be used without amplifiers. For resistance-type gauges, amplifiers are required to cover from 0 to about 1 500 c/s.

621.365.5 **695**

Crucible Failure in the Induction Melting Process.—A. Gemant & J. Sticher. (*J. appl. Phys.*, Nov. 1945, Vol. 16, No. 11, pp. 661–667.) Zirconia crucibles occasionally melt locally owing to overheating although the melting point is far in excess of that of most alloys commonly used. A theory is developed which shows that the overheating is more probable the steeper the electrical resistivity/temperature characteristic of the zirconia. The fault may be due to impurities.

621.365.5 : 621.315.615 : 621.319.4 **696**

Capacitors for High-Frequency Induction-Heating Circuits.—Clark & Scoville. (*See* 636.)

621.365.5 : 621.785.6 : 669.14 **697**

Superficial Hardening [of steel] **by Medium-Frequency Induction Heating.**—Seulen & Voss. (*Génie civ.*, 15th June 1944, Vol. 121, No. 12, p. 100.) Short abstract of a paper in *Stahl und Eisen*, 23rd & 30th Dec. 1943. Frequencies of 600 c/s to 2 Mc/s are used according to the thickness required for the hardened layer.

621.365.92 **698**

[Dielectric] **Heating by High-Frequency Currents.**—G. Génin. (*Rev. gén. Élect.*, Oct. 1945, Vol. 54, No. 10, pp. 291–297.) Particular reference to the application to rubber vulcanization processes, and to the economics of the method in general (cost of generator, and of the energy used). A simple analysis of the limiting factors leads to the conclusion that the process is applicable to materials of which the " loss factors " (product of power factor and permittivity) range between 0.005 and 0.01. The article is essentially a survey, with a bibliography of 19 references.

621.369.2 **699**

The Drying of Varnished or Humid Surfaces by Radiation : Descriptions of Infra-Red Installations.—B. Haznadaroff. (*Rev. gén. Élect.*, Oct. 1945, Vol. 54, No. 10, pp. 298–302.) In addition to detailed descriptions of equipment and applications, the paper contains a qualitative theoretical discussion leading to the conclusion, verified by a simple experiment, that an irradiated varnished metal surface may reach a higher temperature than a similar unvarnished surface.

623.26 : 621.396.9 **700**

Non-Metallic Mine Detector.—T. E. Stewart. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 100–103.) A description of equipment type AN/PRS-1, and its method of adjustment and use in the detection of both metallic and non-metallic mines located a few inches below the surface of the ground. It comprises a 300 Mc/s oscillator carried at the end of a suitable exploring handle : a horizontal dipole is coupled to the oscillator and a reflecting dipole is mounted above the first. Alterations in the oscillator grid current are arranged to vary the amplitude of an a.f. note heard in the operator's headphones. The batteries and a.f. apparatus are carried on the operator's back. In operation it is arranged that the resonant frequency of the dipole is lower than that of the oscillator. The ground is explored with the antenna a few inches above the surface. Non-metallic mines increase the resonant frequency of the antenna, thus decreasing grid current and increasing the intensity of the audible note, while metallic mines produce an increase of grid current and a decrease in the audible indication.

621.396.933.083.7 : 629.13 **701**

Plane-to-Ground Radio Telemetering.—D. W. Moore, Jr. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 125–127.) In flight testing of aircraft or in the control of aircraft flight by radio means it is necessary to reproduce on the ground the readings of the various aircraft instruments. This has been done by attaching to the pointer of each instrument a small permanent magnet that controls the phase of a 500 c/s note. The note is transmitted to ground over a radio link, together with a 250 c/s note which serves as a reference for phase. The two signals received on the ground are used to actuate an instrument similar to the primary instrument in the aircraft.

622.19 : 621.395.645.33 **702**

Geophysical Prospecting Equipment.—D. Sheffet. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 116–123.) A field seismograph may consist of groups of twenty-four or more seismometers connected by multi-conductor cables to a control and test panel in the recording van. The outputs of the groups are fed to a number of identical amplifiers connected to a multiple recording oscillograph. The input signals to the amplifiers may vary by 10 000 to 1 ; to reduce this to an average of 2 to 1 at the oscillograph either automatic volume control or pre-adjusted time-rate expansion, to vary the gain with time, is employed. Filters are used to restrict the frequency range of the amplifiers, which must be identical in amplitude and phase response. Accurate control of the timing circuits is accomplished by the use of a 100 c/s temperature-compensated tuning fork.

623.454.25 : 621.396.9 **703**

The Proximity Fuse.—(*See* 623/626.)

629.13 : 621.389 **704**

Electronic Timer for Aircraft De-Icer.—D. W. Bloser & G. R. Holt. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 152–155.) A thyratron timing circuit is used to control the rate of operation of the de-icing boots. Any one of four rates can be selected to counter the different icing conditions that may occur.

629.13 : 621.396 **705**

Aviation Communication Systems.—Rentzel. (*See* 604.)

621.317.39 **706**

Electrical Measurements of Mechanical Quantities [Elektrische Messung mechanischer Grössen : Book Review].—P. M. Pflier. Springer, Berlin, 2nd edition 1943, reprinted (in German) by J. W. Edwards, Ann Arbor, Mich., U.S.A., 259 pp., $6.50. (*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 220..222.) " The book will prove an excellent reference . . . " See also 1705 of 1945.

621.38 **707**

Electronic Equipment and Accessories [Book Review].—R. C. Walker. George Newnes, London, 1945, 428 pp., 25s., and Chemical Pub. Co., Brooklyn, N.Y., $6.00 (*Proc. Instn Radio Engrs, Aust.*, Oct. 1945, Vol. 6, No. 4, p. 15. Also *Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, p. 225.) See also 3751 of 1945.

621.386 : 6 **708**

Die Photozelle in der Technik [Book Review].—H. Geffcken & H. Richter. J. Schneider, Berlin-Tempelhof, 3rd edn., RM 2. (*Akust. Z.*, Sept. 1940, Vol. 5, No. 5, p. 364.)

PROPAGATION OF WAVES

551.51.053.5 : 621.396.11 **709**

On the Propagation of Radio Waves.—O. E. H. Rydbeck. (*Chalmers tekn. Högsk. Handl.*, 1944, No. 34, 168 pp. In English.) Full paper of which the author's summary was noticed in 1382 of 1945. Tables of useful cylinder functions of order ±1/3 and ±2/3 are given with interval 0.02 from $x = 0$ to 1, and interval 0.2 from $x = 0$ to 8.

551.51.053.5 : 621.396.11 **710**

On the Question of Short-Wave Propagation.—O. Burkard. (*Funktech. Mh.*, May 1945, No. 5, pp. 65–66.) A satisfactory theoretical explanation of short-wave long-distance communication has not yet been given. The theory of multiple reflection between the ionosphere and earth is inadequate (*e.g.* there are not multiple annular skip-zones around the transmitter). The theory of gradual bending in the ionosphere is unacceptable because, *e.g.*, very small changes in the intensity of ionization in the refracting layer would produce very large changes in range of the signal, so that, contrary to observation, long-distance communications would be confined to very brief intervals when the refracting conditions give exactly the correct range. The existence of " gliding " waves that follow the lower boundary of the ionosphere is proposed. They are somewhat analagous to Sommerfeld's ground waves. The " conducted " waves proposed by Uller (*Jb. drahtl. Telegr.*, 1917, Vol. 15, p. 123, *Z. ges. Naturwissenschaft*, 1939, Vols. 9/10, p. 353.) are not the same, for the conditions necessary for the existence of " conducted " waves are usually not possible in the upper atmosphere.

Following the work of Joos (2642 of 1939), the part of the " gliding " wave that is in the ionosphere has its wave fronts perpendicular to the base of the ionized layer, the part that is in the unionized air below has its wave fronts trailing behind, and energy is radiated obliquely downwards. Taking account of the earth's curvature, this oblique radiation will reach the earth if the angle between its direction of propagation and the vertical is less than a critical value, which is about 75° for a layer height of 230 km. For 30 Mc/s waves this critical angle is calculated to be given by a density of ionization corresponding to a critical frequency of 7.76 Mc/s, which agrees almost exactly with the value for the critical frequency (7.8 Mc/s) observed for limiting long-distance propagation. Other evidence giving qualitative confirmation of the existence of " gliding " waves is mentioned.

621.3.011.2 + 621.3.011.5].029.62 : 631.437 **711**

The Electrical Properties of Soil at Wavelengths of 5 Metres and 2 Metres.—J. S. McPetrie & J. A. Saxton. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 247–255.) " The paper gives the results of a year's observations on the electrical constants of a grass-covered sandy loam site at the National Physical Laboratory. Measurements of the reflection coefficient of the ground for radiation of wavelength 5 m indicated that the dielectric constant varied between 5 and 25, and that the conductivity varied from 0.7×10^8 to 4×10^8 e.s.u. Measurements of the attenuation in soil were also made at wavelengths of 5 m and 2 m, and the results indicated similar values for the electrical constants."

621.396.11 : 631.437 **712**

A Note on the Variation of the Ground Absorption Factor with Distance in India at Medium Wave Broadcasting Frequencies.—S. Ramaswamy. (*Electrotechnics*, Sept. 1945, Nos. 17/18, pp. 104–107.) " Methods for calculating this factor have been given and the actual results for Lahore medium-wave broadcasting station have been worked out."

538.56 + 532.59 + 534] "1687–1943" : 016 **713**

Waves and Wave Action [Book Review].—C. C. Lee, Vicksburg, Miss., U.S.A., revised 1944, 91 pp., $5.00. (*Elect. Engng*, Oct. 1945, Vol. 64, No. 10, p. 382.) Annotated bibliography of about 800 books, periodicals, and society publications appearing from 1687 to Dec. 1943.

RECEPTION

621.396/.397].62 **714**

" Design of Broadcast and Television Receivers for the Post-War Market." —(*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 298–299.) I.E.E. Radio Section discussion, led by L. H. Bedford, of the relation between elaboration of design and the economic and manufacturing problems of radio industry after the war. Reference is made to projection *vs.* direct-viewing, and to the limited contribution of radar technique to television receiver design.

621.396.62 : 519.283 **715**

Sensitivity Limits in Radio Manufacturing.—A. S. Blatterman. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 141–143.) A discussion of the statistical considerations underlying the fixing of acceptance limits for the sensitivity of radio receivers coming off a production line. A selected set of average valves is used to determine whether a rejection is due to valve or circuit deficiency.

621.396.621 **716**

Bicycle Radio with 4 Tubes.—R. B. Essex. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 172..189.) A superheterodyne receiver using battery supplies and miniature valves, mounted on the handlebars.

621.396.621 **717**

Miniature Pocket Receiver Design.—W. J. Brown. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 33–37, 54.) Hearing aid technique is used to obtain a radio receiver $6 \times 2\frac{1}{2} \times 1\frac{3}{16}$ inches in size, including batteries. The earphone leads are also the aerial. The circuit includes an r.f. pentode, a tetrode detector, either anode-bend or grid-leak, an a.f. tetrode and an output tetrode. Daylight outdoor range on a 50 kW broadcasting station is from 20 to 100 miles.

621.396.621.029.62 **718**

Build Your Own V.H.F. FM-AM Receiver.—A. Rattray. (*Radio News*, Dec. 1945, Vol. 34, No. 6, pp. 29..159.) Circuit diagrams and constructional details of a receiver to cover the frequency range 88–108 or 115–140 Mc/s. Acorn valves are used for the r.f. amplifier, oscillator and mixer. Two high-gain i.f. stages at 4.3 Mc/s are followed by a stage operating as a low-gain i.f. amplifier for a.m. reception, and as a limiter for f.m. signals.

621.396.621.52.029.56/.62 **719**

Explorer All-Wave Radio.—B. White. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 96..135.) Design and construction of a regenerative receiver for 4.5 to 665 metres using plug-in coils.

621.396.622 : 621.396.619.018.41 **720**

F-M Ratio Detectors.—Peters. (*See* 574.)

621.396.622 : 621.396.619.018.41 **721**

F.M. Detector.—W. R. Ferris. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, p.194.) The incoming wave is incident on a plane or concave diffraction grating with line spacing about one wavelength. A plurality of probes, or dipoles, are placed in the frequency-sensitive zones of maximum field strength of the resultant diffraction pattern. Summary of U.S. patent 2 367 764.

621.396.623 **722**

[Receiver] **Power Output Stages.**—J. King. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 173..207.) Points considered include impedance matching, bias resistance, cathode bypass condenser, output transformer ratio, effect of speaker coil inductance, and use of push-pull.

621.396.662 **723**

Practical Radio Course : Part 39 [Push-button station selectors].—Ghirardi. (*See* 772.)

621.396.665 **724**

Radio Design Worksheet : No. 42 – Some Notes on Automatic Volume Control : Parallel Resonance.—(*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 51–52.) Application of simple time constant theory to the design of orthodox a.v.c. circuits.

621.396.682 : 621.396.621 **725**

Electrification for the Old Set.—G. A. Chase. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 177–178.) A detailed description of the conversion of a battery operated receiver to a.c. mains operation at 110–120 V.

621.396.828 **726**

Reduction of Heterodyne Interference.—H. W. Belles. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 150–151.) The amplitude and phase modulations of the desired carrier signal that are produced by adjacent channel signals, are separately rectified in balanced rectifier circuits. The rectified outputs are combined in opposition, leaving only the desired signal. Attenuation of strong interfering signals to below audibility has been accomplished without effect on the wanted signal.

621.396.932 **727**

Boat Radio Installations.—H. B. O. Davis. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 94..138.) The factors governing the selection and installation of transmitters and receivers for small craft.

621.396/.397].621 **728**

Radio Receiver Design – Part II [Book Review].—K. R. Sturley. Chapman & Hall, London, 1945, 479 pp., 28s. (*Electronic Engng*, Jan. 1946, Vol. 18, No. 215, p. 30.) See also 414 of February.

STATIONS AND COMMUNICATION SYSTEMS

621.3(41) " 1939/1945 " **729**

British Electrical Engineers and the Second World War.—P. Dunsheath. (*Engineering, Lond.*, 26th Oct., 2nd Nov. & 9th Nov. 1945, Vol. 160, Nos. 4163, 4164 & 4165, pp. 335, 360–361 & 383–384. *Beama J.*, Oct. & Nov. 1945, Vol. 52, Nos. 10 & 11, pp. 332–337 & 374–380.) Further summaries of the I.E.E. presidential address. See 415 of February.

621.396 **730**

Communication Development.—A. H. Mumford. (*Electrician*, 26th Oct. 1945, Vol. 135, No. 3517, pp. 437–438.) Summary of inaugural address of Chairman I.E.E. Radio Section. See also 4046 of 1945.

621.396 : 629.13 **731**

Aviation Communication Systems.—Rentzel. (*See* 604.)

621.396.44 (091) **732**

New Systems of Carrier Current Transmission.—A. Marzin. (*Génie civ.*, 1st July 1944, Vol. 121, No. 13, p. 107.) Short abstract of an historical paper read before the Soc. franç. des Électriciens.

621.396.619.018.41 **733**

New FM Bands.—A. Jay. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 163..216.) Trouble due to skywave transmission was possible on the old 40–50 Mc/s band. Propagation characteristics of the new 88–106 Mc/s band are discussed. Replies to a questionnaire on the new f.m. frequency allocations are given.

621.396.619.018.41 **734**

Frequency Modulation.—K. R. Sturley. (*J. Instn elect. Engrs*, Part I, Dec. 1945, Vol. 92, No. 60, pp. 455–456.) Long summary of 4047 of 1945.

621.396.619.018.41 : 621.396.61.029.62 **735**

Simplified F.M.—Geist. (*See* 788.)

621.396.619.018.41 : 621.396.81 **736**
Range Prediction Chart for F-M Stations.—F. C. Everett. (*Communications*, Nov. 1945, Vol. 25, No. 11, p. 57.) Gives the range from transmitter power, aerial height, distance, and desired field strength at the receiver, for "average" ground constants, based on 98 Mc/s, horizontal polarization.

621.396.619.018.41 : 621.396.81 **737**
Ground Wave Range Calculator for FM.—(*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, p. 109.) A chart linking field strength, transmitter height and distance, based on a frequency of 98 Mc/s and 30 ft receiving antenna. Similar data to that presented in 736 above, but in a different form.

621.396.619.018.41 + 621.397.24].052 **738**
Transmission Networks for Frequency Modulation and Television.—H. S. Osborne. (*Elect. Engng, N.Y.*, Nov. 1945, Vol. 64, No. 11, pp. 392–397.) Present and possible future f.m. requirements in the U.S. using ordinary telephone wires for local circuits and carrier telephone networks for inter-city connexions can be met with existing plant. For short-distance television transmission ordinary telephone pairs with special equipment have been used, and the use of existing or improved coaxial cables for longer distances has been advocated. Experiments at 2, 4 and 12 Mc/s have been started on microwave relay systems, and the possible use of waveguides is considered. The programme of the Bell System Companies to meet these broad-band developments is included.

621.396.619.16 **739**
Pulse Modulation.—C. W. Hansell. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, p. 128.) Odd pulses are delayed and even pulses are advanced relative to the unmodulated pulse-train during the positive half cycle of the modulation, and *vice versa* during the negative half cycle. This allows higher peak power, use of higher frequencies, improved signal-to-noise ratio and a degree of secrecy. Diagrams are given. Summary of U.S. patents 2 379 899 and 2 379 900.

621.396.619.16 **740**
Pulse-Time Modulation.—D. Philips. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 46..86.) A transmitter of about 4 500 Mc/s is modulated with a 4 μs marker pulse and eight 1 μs carrier pulses, forming a frame with a repetition rate of 8 000 c/s. Each carrier pulse provides a channel which conveys intelligence by the movement of the pulse in time relative to the marker pulse. The magnitude of this movement is proportional to the amplitude of the modulation. The receiver contains gating circuits, which are synchronized with the transmitter by the marker pulse, and which separate the carrier pulses into the eight output circuits.

Demonstrations of a Federal Telephone & Radio Corp. 24-channel 40-mile inter-city system, Bell Telephone Lab. military set AN/TRC-6, and RCA military set AN/TRC-5 are described.

621.396.619.16 **741**
PT Modulation for Multiple Transmission.—(*Electronic Industr.*, Vol. 4, No. 11, pp. 90–91.) Account of the Federal Telephone and Radio Corp. system. See also 740 above.

621.396.619.16 **742**
Pulse-Time Modulation.—(*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 161..197.)

621.396.63 : 621.396.619.018.41 **743**
FM Radio Relay.—J. M. Lee. (*Radio News*, Dec. 1945, Vol. 34, No. 6, pp. 54..154.) U.S. Army equipment for linking to a telephone system. Frequency 70–100 Mc/s with a transmitter power of 50 W, or 250 W with an additional amplifier. Phase-shift modulation is used, with deviation up to ± 30 kc/s.

621.396.712 **744**
The CBC H-F Global Transmitting System.—R. D. Cahoon. (*Communications*, Oct. 1945, Vol. 25, No. 10, pp. 60..87.) An account of the station described in 193 of January.

621.396.97(091) **745**
25th Anniversary of Radiobroadcasting.—(*Elect. Engng, N.Y.*, Oct. 1945, Vol. 64, No. 10, pp. 365–366.) "History and events that led to the first scheduled broadcast of November 2nd, 1920, from the first established station, KDKA, Pittsburgh."

621.396.97.029.62 **746**
On the Possibility of an Ultra-Short-Wave First Grade Broadcasting Service in India.—S. P. Chakravarti. (*Electrotechnics*, Sept. 1945, Nos. 17/18, pp. 96–103.) Tropical countries, and India in particular, present special problems, *e.g.* high level of atmospherics and man-made static, large seasonal variation of ground conductivity, comparatively low and dense ionosphere, inadequate funds. It is probable that the highest efficiency would be obtained from about 60 low-power stations operating on a wavelength of 5 metres.

621.39 **747**
Jahrbuch des elektrischen Fernmeldewesens [Book Review].—F. Gladenbeck. Georg Heidecker, Berlin, 1940, 379 pp., RM 22. (*Akust. Z.*, July 1940, Vol. 5, No. 4, p. 233.) An account of the research by the German post office during the year.

621.39(05) **748**
Communication Review.—A quarterly house journal newly published by Communication Engineering Pty. Ltd., Sydney, Australia. The contents of the first number are mainly concerned with carrier-cable telephony and associated equipment.

SUBSIDIARY APPARATUS

531.788.7 **749**
Manometer Circuit.—Calbick. (*See* 629.)

533.56 **750**
High-Vacuum Pumping.—(*See* 630.)

535.312 **751**
Directive Optical Systems.—(*Electronic Engng*, Jan. 1946, Vol. 18, No. 215, pp. 27–28.) The transmission of light beams by internal reflections along Perspex rods, for photo-cell and other applications. The amount of light transmitted is shown for typical cases.

621.3.042.5 **752**
Multiple Magnetic Circuits.—J. F. Manildi. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 160–163.) It is shown how the field in the gap of, say, a measuring instrument may be increased for the same gap configuration and amount of magnetic

material by using a number of parallel elements in the magnetic circuit to replace a single series element.

621.314.2 **753**

Design Construction and Testing of Radio Power Transformers.—P. Prabhakar & V. V. L. Rao. (*Electrotechnics,* Sept. 1945, Nos. 17/18, pp. 108–121.) After a brief description of various parts, empirical formulae for determining the core size, wire size, and number of turns, are given. Useful constructional hints and an illustrative example are included.

621.314.5 **754**

The Design of Non-Synchronous Vibrators for Radio Sets and Equipment.—R. N. Dewan. (*Electrotechnics,* Sept. 1945, Nos. 17/18, pp. 125–133.) Their underlying principles are discussed and details are given of a type made by the author because of their scarcity on the market.

621.315.613.1 : 621.319.4 **755**

Manufacture of Silvered Mica Capacitors.—A. T. Chapman. (*Electronics,* Nov. 1945, Vol. 18, No. 11, pp. 146–149.) " Discussion of mica quality factors, and details of new manufacturing techniques developed [at Western Electric Co.] to conserve existing stocks of mica and . . . improve tolerances and quality standards of finished units." Stresses the importance of proper assembly, processing, and moulding, to ensure that even the best quality mica does not yield capacitors having poor stability and high temperature-coefficient.

621.316.722.078.3 : 621.396.682 **756**

Voltage-Regulated Power Supplies.—G. E. Hamilton & T. Maiman. (*Communications,* Nov. 1945, Vol. 25, No. 11, pp. 44..81.) Electronic means of voltage stabilization which are described include cold cathode gas filled (neon) tubes, μ-bridge stabilizers, transconductance bridge stabilizers, and degenerative amplifiers. The first of two papers.

621.316.74 **757**

Tapered-Thickness Bimetal.—W. B. Elmer. (*Trans. Amer. Inst. elect. Engrs,* Sept. 1945, Vol. 64, No. 9, pp. 661–665.) Bimetal strips for use in thermostats are most economical in the tapered-thickness form. Charts giving corrections to standard formulae for uniform strips are included. Formulae for determining the fundamental frequency of vibration of single- and dual-tapered strips are also given.

621.316.74 : 621.396.611.2 **758**

Design of Thermostatic Ovens.—T. S. Skillman. (*Communication Rev.,* 1945, Vol. 1, No. 1, pp. 41–45.) An oven is described, capable of accommodating the tuning circuits of 16 oscillators and of maintaining a temperature constant to within ± 0.15° C.

621.316.74 : 621.396.611.21 **759**

[Quartz] **Crystal Oven Anticipates Temperature Changes.**—(*Electronics,* Nov. 1945, Vol. 18, No. 11, pp. 406..414.) " . . . it consists of an inner Bakelite chamber to hold the crystals, an insulating air chamber surrounding the Bakelite one and containing heating coils and a limiting [bimetal] thermostat, and an outside Bakelite cover." It is a small unit with standard 11-pin base, to operate with ambient temperatures − 40° C to + 70° C and control the internal temperature to 1° C.

621.316.93 **760**

Lightning Investigations on 33-Kv Wood-Pole Lines.—F. E. Andrews & G. D. McCann. (*Trans. Amer. Inst. elect. Engrs,* Vol. 64, No. 11, pp. 768–777.) A study of the lightning performances of various types of line design and lightning protection. The investigation made use of photographic surge-current recorders and surge-crest-ammeter links installed on lines. Detailed data were obtained for wood-pole lines continuously protected by overhead ground wires and by deion protector tubes.

621.317.755.087.5 **761**

A Continuous Film-Recording Camera for Use with Standard Cathode-Ray Oscilloscopes.—A. H. Simons. (*Electronic Engng,* Jan. 1946, Vol. 18, No. 215, pp. 10–12.) A friction-drive camera taking 85 mm film or paper, perforated or unperforated. Film speed continuously variable 12.5–50 in/s, f/4.5 lens, no shutter, 100 ft spools. Two discharge lamps are fitted for making timing marks on each edge of the film.

621.318.323.2 : 621.396.662.2 **762**

Effective Permeability of High Frequency Iron Cores.—Polydoroff & Klapperich. (*See* 646.)

621.318.42 **763**

Optimum Air Gap for Various Magnetic Materials in Cores of Coils Subject to Superposed Direct Current.—V. E. Legg. (*Trans. Amer. Inst. elect. Engrs,* Oct. 1945, Vol. 64, No. 10, pp. 709–712.) The method developed is used to calculate curves from which the design dimensions can be obtained to meet specified requirements of inductance, resistance, and d.c. burden. Special cases, in which other quantities are specified, are considered.

621.318.42.017.31 **764**

Eddy-Current Resistance of Multilayer Coils.—T. H. Long. (*Trans. Amer. Inst. elect. Engrs,* Oct. 1945, Vol. 64, No. 10, pp. 712–718.) Formulae suitable for strip-wound coils with partial magnetic circuits (e.g., in the slots of machines) are extended to apply to coils wound from round wire having no external magnetic circuit, by assuming a fictitious permeability and wire of an equivalent square section, which " seems to give results of usable accuracy".

621.318.423 **765**

The Self-Inductance of a Toroidal Coil Without Iron.—H. B. Dwight. (*Trans. Amer. Inst. elect. Engrs,* Nov. 1945, Vol. 64, No. 11, pp. 805–806.) A method for computing the inductance of a coil with rectangular section and a comparatively thick winding, based on the product of magnetic flux lines and the number of turns linked.

621.319.4.011.4 **766**

Resistance and Capacitance Relations Between Short Cylindrical Conductors.—F. L. ReQua. (*Trans. Amer. Inst. elect. Engrs,* Oct. 1945, Vol. 64, No. 10, pp. 724–730.) Formulae are given for a number of side-by-side dispositions of the conductors, taking account of end effects. These give results in better agreement with experiment than the conventional formulae which assume the length of the conductors great compared with their distance of separation.

621.384.6 **767**

100,000,000-Volt Betatron.—(*Sci. News Lett., Wash.*, 3rd Nov. 1945, Vol. 48, No. 18, pp. 278–279.) Popular account of the device described in 438 of February.

621.385.832 **768**

Application Techniques for Cathode-Ray Tubes.—Christaldi & Lempert. (*See* 775.)

621.386 **769**

Industrial X-Ray Tubes.—Z. J. Atlee. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 136–140.) A survey of properties of X-ray tubes for microradiography and diffraction, at voltages from 50 kV to 2 MV peak. Difficulty has been encountered in providing targets with a wide range of atomic number. The atomic number of the target should be lower than that of the material under examination by diffraction.

621.386 (091) **770**

Roentgen-Ray Tubes.—W. D. Coolidge & E. E. Charlton. (*Gen. elect. Rev.*, Nov. 1945, Vol. 48, No. 11, pp. 36–41, 44–51.) An authoritative review of developments in the past 50 years.

621.396.622.6 : 546.28 **771**

Silicon Crystals for UHF Detection Circuits.—E. C. Cornelius. (*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 74..140.) At frequencies of the order of 1 000 Mc/s and upwards the diode detector is no longer serviceable and has been replaced by a silicon crystal and tungsten "cat's whisker". The combination is assembled in a ceramic cartridge and embedded in wax. The performance is much improved by the inclusion in the silicon of controlled small amounts of other substances. The operating conditions are discussed with the aid of an equivalent circuit diagram.

621.396.662 **772**

Practical Radio Course : Part 39 [Push-button station selectors].—A. A. Ghirardi. (*Radio News*, Dec. 1945, Vol. 34, No. 6, pp. 56..136.) Reviews various selector systems and the special oscillator preselector tracking problems that arise. Considers very fully systems using preset trimmers or tuned circuits with capacitance or inductance tuning.

621.396.662.2 **773**

Winding Universal Coils.—A. W. Simon. (*Electronics*, Nov. 1945, Vol. 18, No. 11, p. 170.) Simple rules for modifying a coil of known self-inductance so as to obtain a desired inductance value. Similar rules are given for locating the tap on a coil and for adjusting the mutual inductance or coupling coefficient between two coils to a required value.

621.396.682 : 621.396.621 **774**

Electrification for the Old Set.—Chase. (*See* 725.)

TELEVISION AND PHOTOTELEGRAPHY

621.385.832 **775**

Application Techniques for Cathode-Ray Tubes.—P. S. Christaldi & I. E. Lempert. (*Proc. Radio Cl. Amer.*, Nov. 1945, Vol. 22, No. 1.) Comprehensive recommendations for the selection of cathode-ray tubes, and for the design of appropriate power supplies, with special reference to the use of makers' specifications.

621.396.619.018.41 + 621.397.24].052 **776**

Transmission Networks for Frequency Modulation and Television.—Osborne. (*See* 738.)

621.396/.397].62 **777**

"Design of Broadcast and Television Receivers for the Post-War Market".—(*See* 714.)

621.397 **778**

Television Developments.—(*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 371–372.) A description of the system referred to in 230 of January.

621.397.26(73) "1927–1944" **779**

Television Broadcasting Practice in America – 1927 to 1944.—D. G. Fink. (*J. Instn elect. Engrs*, Part I, Dec. 1945, Vol. 92, No. 60, pp. 457–458.) Long summary of 3955 of 1945.

621.397.3 **780**

"Colour Television".—(*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 258–259.) Report of I.E.E. discussion led by L. C. Jesty embracing point, line, and frame scanning using the minimum requirement of three primary colours, and definition, bandwidth, and colour fringing on moving objects.

621.397.5 **781**

Studio Technique in Television.—D. C. Birkinshaw & D. R. Campbell. (*J. Instn elect. Engrs*, Part I, Dec. 1945, Vol. 92, No. 60, p. 459.) Long summary of 3961 of 1945.

621.397.62 **782**

Functions of Video Circuit.—E. M. Noll. (*Radio News*, Dec. 1945, Vol. 34, No. 6, pp. 48..151.) Explains the need for d.c. restoration on the picture tube to maintain correct average brightness, and describes the necessary video circuits.

621.397.82 **783**

Multipath Interference in Television Transmission.—D. I. Lawson. (*J. Instn elect. Engrs*, Part I, Dec. 1945, Vol. 92, No. 60, pp. 460–461.) Long summary of 3958 of 1945.

621.386 : 6 **784**

Die Photozelle in der Technik [Book Review].—H. Geffcken & H. Richter. J. Schneider, Berlin-Tempelhof, 3rd edn., RM 2. (*Akust. Z.*, Sept. 1940, Vol. 5, No. 5, p. 364.)

621.397.5 **785**

Television Programming and Production [Book Review].—R. Hubbell. Murray Hill Books, New York, 1945, 207 pp., $3.00. (*Elect. Engng*, Oct. 1945, Vol. 64, No. 10, p. 382.) "Provides a foundation for the techniques. . . ."

TRANSMISSION

621.396.61.029.56/.58 **786**

A Four-Band 125-Watt Transmitter.—B. Goodman. (*QST*, Dec. 1945, Vol. 29, No. 12, pp. 22–24.) Oscillator and doubler include 7C5 tetrodes, amplifier 4D32 tetrode ; operation is on 3.5, 7, 14, or 28 Mc/s.

621.396.61.029.58 **787**

Engineering Details of OWI 200 Kw Units.—H. Romander. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 100..162.) This fully modulated inverted amplifier operating in the range 6-22 Mc/s occupies a space 22½ ft × 6 ft × 6¼ ft and is driven by a 50 kW transmitter. It includes two F-135-A tubes. A motor-driven shorting bar is used to tune a pair of copper pipes which, together with a second pair coupled to the antenna, form the anode circuit. Push-pull circuits are used in the a.f. equipment; satisfactory harmonic suppression and good stability are obtained with three negative feedback loops. The main rectifier has twelve F-857A rectifiers arranged in a three-phase full-wave rectifier circuit with a transformer bank connected in delta-delta.

621.396.61.029.62 : 621.396.619.018.41 **788**

Simplified F.M.—J. C. Geist. (*QST*, Dec. 1945, Vol. 29, No. 12, pp. 29..90.) A 2½ metre a.m. or f.m. transmitter. For a.m. the modulator is connected to the final amplifier. " With the switch in the f m. position the oscillator is [anode] amplitude modulated at a low percentage. Amplitude modulation of the self-excited oscillator also causes frequency modulation. . . . Since the depth of modulation is kept low, the amplitude modulation is wiped out by the succeeding Class-C stages. The frequency modulation remains. . . . The resulting output from the transmitter is a virtually constant-amplitude frequency-modulated carrier."

621.396.61.029.62 : 621.396.645.31.029.62 **789**

300 Watts on 50 and 144 [Mc/s].—E. P. Tilton. (*QST*, Dec. 1495, Vol. 29, No. 12, pp. 25–28.) A frequency-tripler and amplifier for use with the 50 Mc/s a.m.–f.m. transmitter described in 468 of February.

621.396.615 **790**

Notes on the Stability of LC Oscillators.—Lea. (*See* 569.)

621.396.615 **791**

On the Frequency Maintained by a Valve Oscillator.—Queffelec. (*See* 570.)

621.396.615.14 **792**

Some Measurements on Micro-Radio Waves of Wavelengths from 15 to 19 Centimetres.—Das & Chakravarti. (*See* 803.)

621.396.615.17.029.62 **793**

Frequency Multiplication for the V.H.F. Bands.—H. A. Gardner. (*QST*, Dec. 1945, Vol. 29, No. 12, pp. 45..102.) Points considered are the choice of valves, the use of push-pull circuits, frequency checking, and decoupling. Circuits are given for a 50 Mc/s transmitter controlled by a 3.5 Mc/s crystal and a 144 Mc/s transmitter using either a 3.6 or a 7.2 Mc/s crystal.

621.396.645.31 **794**

Role of the Neutralizing Capacitor in Tuned Power Amplifiers.—Pritchett. (*See* 577.)

621.396.932 **795**

Boat Radio Installations.—H. B. O. Davis. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 94..138.) The factors governing the selection and installation of transmitters and receivers for small craft.

VALVES AND THERMIONICS

537.58 **796**

Saturation Currents of Thermionic Emission in Vacuum.—C. Macherey. (*Génie civ.*, 1st/15th Nov. 1944, Vol. 121, Nos. 21/22, pp. 170–172.) Calculation of the effect of space charge on the current between plane electrodes, and an account of the range of application of Richardson's and Child's formulae.

537.583 : 621.385 **797**

Measuring Emission Characteristics with Pulse Technic.—R. L. Sproull. (*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 112–113.) Long summary, with diagrams, of 2642 of 1945.

621.385 **798**

Tube Replacements.—I. Queen. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 100–101.) U.S. valves with identical characteristics but different bases or filament voltages are listed.

621.385 : 621.791.352 **799**

Brazing Operations in Transmitter Tube Assembly.—(*See* 651.)

621.385.16 **800**

Centimeter-Wave Magnetrons.—H. F. Argento. (*QST*, Dec. 1945, Vol. 29, No. 12, pp. 17–21.) The anode of a cavity magnetron consists of a thick-walled copper cylinder with a number of identical key-hole shaped slots opening into the inner face. Precision machining of a solid block has been replaced by building up from punched sheets and brazing, thus expanding production rates ten times. The oxide-coated cathode may give up to 100 A emission current. Peak outputs of up to a 10^6 W on microsecond pulses are obtained at centimetre wavelengths with about 50% efficiency, 30 000 V input, and magnetic fields of 2 000 gauss. Tunable magnetrons and velocity-modulated tubes are briefly described.

621.385.18 : 621.316.722.078.3 **801**

Utilizing the VR-Series Tubes.—W. H. Anderson. (*QST*, Dec. 1945, Vol. 29, No. 12, pp. 36–37.) Basic design data and nomographs are given for voltage regulators using a simple circuit with gas-filled stabilizing tubes.

621.385.8 **802**

Sensitive Gas Relay Tube.—J. Reiss. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 450..458.) Summary of 3302 of 1945.

621.396.615.14 **803**

Some Measurements on Micro-Radio Waves of Wavelengths from 15 to 19 Centimetres.—P. N. Das & S. P. Chakravarti. (*Electrotechnics*, Sept. 1945, Nos. 17/18, pp. 78–84.) A 4036A triode is used to generate Barkhausen oscillations in the range 1 580–2 000 Mc/s and some estimates of the power output are made.

MISCELLANEOUS

519.283 **804**

Statistical Methods in the Development of Apparatus Life Quality.—E. N. Ferrell. (*Elect. Engng*, Oct. 1945, Vol. 64, No. 10, p. 367.) Abstract of a paper before the Amer. Inst. Elect. Engrs.

519.283 **805**

Statistical Methods in Quality Control I–VI.—A.I.E.E. Sub-committee on Educational Activities. (*Elect. Engng, N.Y.*, May/Nov. 1945, Vol. 64, Nos. 5/11, pp. 181..402.) The first six parts of a series dealing, respectively, with I. Variability of quality/frequency distributions; II. Measurement by variables and by attributes; III. Frequency distribution for set-up check of process; IV. Sub-grouping of data, finding causes of trouble; V. Variations to be expected in sampling; VI. Charts for go-and-no-go inspection.

620.193 **806**

Some Practical Instances of the Corrosion of Non-Ferrous Metals in Telecommunications Plant.—W. G. Radley. (*J. sci. Instrum.*, Dec. 1945, Vol. 22, No. 12, pp. 237–238.) Corrosion of cable sheaths and of bunches of wires behind switchboards is mainly due to moisture and leakage currents. Chemical inhibitors have been used with some success.

620.193 **807**

Controlling Factors in Atmospheric and Immersed Corrosion.—W. H. J. Vernon. (*J. sci. Instrum.*, Dec. 1945, Vol. 22, No. 12, pp. 226–230.) The controlling factor in immersed corrosion is usually either cathodic potential, the production of protective films, or the rate of supply of the promoting factor. In atmospheric corrosion it may be the humidity and impurity of the atmosphere, or the physical properties of the initial film. The influence of these factors is reviewed.

620.193.7 **808**

Electrochemical Measurements for Corrosion Studies.—P. T. Gilbert. (*J. sci. Instrum.*, Dec. 1945, Vol. 22, No. 12, pp. 235–237.) The potentials and corrosion currents of four couples were measured and it was found that (*a*) if the corrosion is largely electrochemical the corrosion current is directly related to the amount of corrosion; (*b*) when two metals are corroding in contact an unknown factor is usually introduced; (*c*) local cathodes on the anode and *vice versa* cause an increase in corrosion; (*d*) with a single metal these local elements cause most of the corrosion, but for an electro-positive and an electro-negative couple, they may be of only secondary importance.

621.394/.396].6(213) **809**

Report on the Deterioration of Telecommunications Equipment in Tropical Areas.—R. J. Collins, C. S. Gittoes & D. W. Rowed. (*Proc. Instn Radio Engrs, Aust.*, Oct. 1945, Vol. 6, No. 4, pp. 3–8.) Report on observations made by the Radio Mission of the Instn Radio Engrs, Aust., with the First Australian Army, July–August 1945. Most faults were due to effects of moisture. Normal air day temperature is 90° F, with 90% relative humidity at night and same moisture content by day. Power-driven equipment is usually sheltered in huts or vehicles and heaters can be fitted to lower the relative humidity. Portable equipment may be exposed to weather and even immersed in water. Moisture lowers the insulation resistance, alters dielectrics, increases the value of some resistors, and may lead to fungus growth. Fungus itself apparently did not affect performance. Faults due to electrolytic action of dissimilar metals were not apparent. Waxes and varnishes increase component life but do not stop moisture absorption. Components should be waterproofed, and it is recommended that variable controls, such as rheostats, should have leads sealed, and glands of silicone around the control shaft. Silicone glands and rubber gaskets can be used for sealing equipment cases. Greater use of thermoplastic insulators is advised as the ambient temperature rarely exceeds 90° F. New ceramics are non-porous and do not need surface treatment. Tough rubber or polyvinyl chloride insulated wires are satisfactory. Dry batteries in sealed cans are weather-proof, and failure, except due to age, is rare. Packing cases should be strong, allow ventilation when stacked, and have metal or plastic inner linings which can be resealed.

Portable equipment should fit inconspicuously on operator. For jungle use r.t. sets with an output of 2W and receiver sensitivity of 1μV are suggested. Batteries need only have a life of a few hours. Erection of large aerials is often impossible, and remote erection would be useful.

621.396.69 **810**

One Facet of Naval Electrical Research [Adaptation of equipment to war conditions].—Seaman. (*See* 650.)

621.798 : 621.396.69 **811**

Hermetic Sealing.—G. Herbert. (*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 44–47, 89.) A satisfactory seal must provide a perfect environment for the functional unit and maintain that condition through all external changes. A practical specification includes 5 cycles of temperature change from + 85° C to − 55° C followed by at least 5 cycles in salt water between + 85° C and 0° C, without insulation resistance falling below the minimum limit. The main protective case can follow the lines of canned-food containers, which prevent the troubles associated with moisture, fungus, dirt, and lowered atmospheric pressure. The insertion of insulated terminals presents many difficulties. Gasket technique has many applications but will not hold gas pressures. Ceramics may be metallized and "blended" into metal cases, but glass to metal seals, as in valve technique, offer many attractions.

519.283 **812**

Sampling Statistics and Applications [Book Review].—J. G. Smith & A. J. Duncan. McGraw-Hill, New York and London, 1945, 498 pp., $4.00. (*Elect. Engng, N.Y.*, Nov. 1945, Vol. 64, No. 11, p. 422.) Fundamentals of the theory of statistics.

621.3.029.5/.6 **813**

Fortschritte der Hochfrequenztechnik – Vol. 2 [Book Review].—F. Vilbig & J. Zenneck (Eds.). Akad. Verlagsges. Becker & Erler Komm.-Ges., Leipzig, 1943, 856 pp., RM 56. (*Z. Ver. dtsch. Ing.*, 5th Aug. 1944, Vol. 88, Nos. 31/32, p. 431.) "The book is important and valuable for the high-frequency physicist and technician." Vol. 1 was noted in 577 of 1942.

621.396 **814**

Modern Radio [Book Review].—K. S. Tyler. Harcourt, Brace & Co., New York, 230 pp., $2.50. (*J. Televis. Soc.*, Dec. 1944, Vol. 4, No. 4, p. 88.) ". . . an excellent example of a semi-technical book . . ."

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534.213.4 : 621.392 **815**

The Analysis of Plane Discontinuities in [acoustic] **Cylindrical Tubes: Part I.**—J. W. Miles. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 259–271.) Using a transmission line analogy the effect of the discontinuity is calculated by considering the higher modes which are excited. The equations of motion of the propagation of a small disturbance in a cylindrical tube yield the two-dimensional wave equation, the solutions of which constitute an infinite set of modes. The analogy with the electrical transmission line is established, and it is shown that each mode requires a separate transmission line.

534.213.4 : 621.392 **816**

The Analysis of Plane Discontinuities in [acoustic] **Cylindrical Tubes: Part II.**—J. W. Miles. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 272–284.) "The theory of plane discontinuities developed in part I [see 815 above] is applied to a 'window' and change of cross section in tubes of both circular and rectangular cross section. In the case of the rectangular tube conformal mapping is introduced as an alternative approach to the problem. Reflection and transmission coefficients are determined from the equivalent circuit of part I, and the theory is also applied to the analysis of certain types of cavity resonators. Finally, the experimental determination of equivalent circuit impedance is discussed."

534.23 **817**

Acoustic Transmission through a Fluid Lamina.—I. Rudnick. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 245–253.) Based on a derivation of the acoustic wave equation for moving media, the transmission and reflection coefficients are derived for a fluid lamina in uniform motion. Some measurements are reported in the frequency range 2 kc/s to 14 kc/s for angles of incidence of between 0° and 89°.

534.231 + 621.396.11 **818**

The Saddle-Point Method in the Vicinity of a Pole with Applications to Wave-Optics and Acoustics.—Ott. (*See* 1024.)

534.232 + 621.396.677 **819**

Small-Dimensional Radiating and Receiving Systems of High Directivity.—Makov. (*See* 857.)

534.232 **820**

Acoustic Intensity Distribution from a "Piston" Source: II. The Concave Piston.—A. O. Williams, Jr. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 219–227.) It is shown how an approximate expansion may be obtained for the r.m.s. excess pressure in the supersonic beam from either a plane or concave piston source when the wavelength is small and the radius of curvature large compared with the aperture of the source. For part I see 2670 of 1945 (Williams and Labaw).

534.321.9 **821**

New Aspect of Ultrasonics.—B. K. Sahay. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 285–286.) The study of ultrasonics may reveal a corpuscular nature of sound energy.

534.321.9 : 620.179 **822**

The Supersonic Reflectoscope, an Instrument for Inspecting the Interior of Solid Parts by Means of Sound Waves.—F. A. Firestone. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 287–299.) Subsidiary reflections take place from flaws in the metal. The signal received by a piezoelectric crystal is displayed on a c.r. tube.

534.41 + 534.781 **823**

Visible Patterns of Sound.—R. K. Potter. (*Science*, 9th Nov. 1945, Vol. 102, No. 2654, pp. 463–470.) Phase relationships between fundamental and harmonics may render waveform records of sound dissimilar to the eye when the differences are indistinguishable to the ear. In the sound spectrograph the record obtained on a magnetic tape is

$$\left.\begin{aligned}\cos\frac{\theta_1}{2} &= \frac{V_A}{|2V_1\cos(\pi/4+\phi/2)|}\\ \cos\frac{\theta_4}{2} &= \frac{-V_A}{|2V_1\sin(\pi/4+\phi/2)|}\end{aligned}\right\}\quad\cdots\quad(16)$$

For a given value of ϕ, V_A will assume a steady value such that the quantity of electricity flowing through G_1 over the period θ_1 is equal to the quantity of electricity flowing through G_4 over the period θ_4 plus the quantity of electricity flowing through the resistance R_2 in one a.c. cycle (2π radians).

The plus sign applies to the case when V_{g1} is greater than V_{g4}. We may write therefore :—

$$\frac{1}{R_1}\int_{-\frac{\theta_1}{2}}^{+\frac{\theta_1}{2}}(V_{g1}-V_A)\,d(\omega t)=\frac{1}{R_1}\int_{-\frac{\theta_4}{2}}^{+\frac{\theta_4}{2}}(V_{g4}+V_A)\,d(\omega t)+\frac{2\pi V_A}{R_2}\quad\cdots\quad\cdots\quad(17)$$

By making R_2 very much greater than R_1 we can ignore it in the following calculations.

$$\therefore\int_{-\frac{\theta_1}{2}}^{+\frac{\theta_1}{2}}\Big[2V_1\cos(\pi/4+\phi/2)\cos\omega t-V_A\Big]\,d(\omega t).$$

$$=\int_{-\frac{\theta_4}{2}}^{+\frac{\theta_4}{2}}\Big[2V_1\sin(\pi/4+\phi/2)\cos\omega t+V_A\Big]\,d(\omega t).$$

This expression reduces to,

$$\frac{2V_1}{V_A}\left[\cos\left(\pi/4+\phi/2\right)\sin\frac{\theta_1}{2}-\sin\left(\pi/4+\phi/2\right)\sin\frac{\theta_4}{2}\right]=\frac{\theta_1}{2}+\frac{\theta_4}{2}\quad\cdots\quad\cdots\quad(18)$$

If we wish to express $\dfrac{V_A}{2V_1}$ in terms of ϕ only we must eliminate $\theta_1/2$ and $\theta_4/2$ in equation (18).

From equation (16) we have,

$$\left.\begin{aligned}\frac{\theta_1}{2} &= \cos^{-1}\cdot\frac{V_A/2V_1}{\cos(\pi/4+\phi/2)}\\ \frac{\theta_4}{2} &= \pi/2+\sin^{-1}\cdot\frac{V_A/2V_1}{\sin(\pi/4+\phi/2)}\end{aligned}\right\}\cdots\ (19)$$

$$\left.\begin{aligned}\therefore\ \sin\frac{\theta_1}{2} &= \sqrt{1-\cos^2\frac{\theta_1}{2}} = \sqrt{1-\frac{(V_A/2V_1)^2}{\cos^2(\pi/4+\phi/2)}}\\ \text{and}\ \sin\frac{\theta_4}{2} &= \sqrt{1-\cos^2\frac{\theta_4}{2}} = \sqrt{1-\frac{(V_A/2V_1)^2}{\sin^2(\pi/4+\phi/2)}}\end{aligned}\right\}\quad\cdots\quad\cdots\quad(20)$$

Thus equation (18) may be rewritten in terms of $V_A/2V_1$, and ϕ only, from which it should be possible to find $V_A/2V_1$ in terms of ϕ.

However, $V_A/2V_1$ is not expressed as an explicit function of ϕ and hence graphical methods must be used to obtain the relationship.

Thus for each value of ϕ chosen, both sides of equation (18) may be plotted for a series of values of $V_A/2V_1$. Where the pairs of curves intersect gives the unique values of $V_A/2V_1$ for the particular values of ϕ chosen. At one point in this process a discontinuity occurs and this will now be discussed.

Referring to Fig. 16 it is clear that as V_{g1} (peak) increases and V_{g4} (peak) decreases, a value of ϕ may be found at which V_{g4} (peak) $= V_A$. At this particular value of ϕ, $\theta_4/2 = \pi$ and for all values of ϕ lying between this value and the value which gives V_{g4} (peak) $= 0$, namely $\phi = -\pi/2$, $\theta_4/2$ will remain constant at the value π.

Let us find this critical value of ϕ.

We have, for $\theta_4/2$ just equal to π.

$$V_A = V_{g4}\ \text{(peak)}$$

$$\therefore V_A = 2V_1\sin(\pi/4+\phi/2)$$

$$\text{or}\quad\frac{V_A}{2V_1}=\sin(\pi/4+\phi/2)$$

From equation (19)

$$\frac{\theta_1}{2}=\cos^{-1}\tan(\pi/4+\phi/2)$$

$$\text{or}\ \cos\frac{\theta_1}{2}=\tan(\pi/4+\phi/2)$$

$$\therefore\ \sin\frac{\theta_1}{2}=\sqrt{1-\tan^2(\pi/4+\phi/2)}$$

Substituting this in equation (18) and remembering that $\frac{\theta_4}{2} = \pi$ we have

$$\cot\left(\pi/4 + \phi/2\right)\sqrt{1 - \tan^2\left(\pi/4 + \phi/2\right)} = \cos^{-1}\tan\left(\pi/4 + \phi/2\right) + \pi$$

$$\text{or } \sqrt{\cot^2\left(\pi/4 + \phi/2\right) - 1} = \cos^{-1}\tan\left(\pi/4 + \phi/2\right) + \pi \quad .. \quad (21)$$

This gives a solution $\phi = -65.5°$.

Thus we use equation (18) as it stands for all values of ϕ from 0 to $-65.5°$, and we use the same equation with π substituted for $\theta_4/2$ for all values of ϕ between $-65.5°$ and $-90°$.

Using this graphical method the curve relating $V_A/2V_1$ with ϕ is plotted in Fig. 17 for values of ϕ from 0 to $-180°$; the curve for values of ϕ from 0° to $+180°$ is identical in shape but with negative values for $V_A/2V_1$.

The flat top to the curve, over the region $-70° > \phi > -110°$ also appears in the results obtained from measurements on this circuit, which are also plotted in Fig. 17.

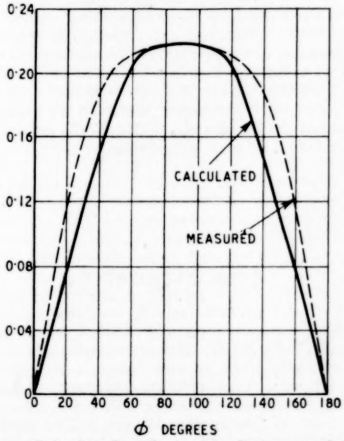


Fig. 17. Calculated and measured characteristics of balanced push-pull phase detector with sine-wave input.

If the other half of the circuit of Fig. 14 had been considered we should have found that the magnitude of the voltage V_B is always equal to V_A, the polarity being such that the potential of X is always equal and opposite to that of Z, relative to Y.

From Fig. 17 we see that the peak value of $V_A/2V_1$ is 0.218

$$\therefore \quad \frac{V_A + V_B}{2V_1} = 0.436 \text{ (Maximum value).}$$

Comparing this value with that obtained from the simple push-pull circuit with sinusoidal input we see that the balanced push-pull circuit is less than 50 per cent as efficient as the former.

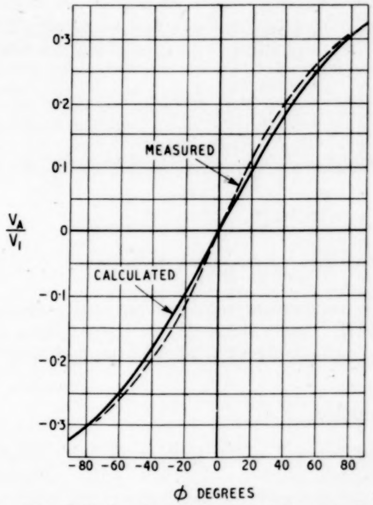


Fig. 18. Calculated and measured characteristics of balanced push-pull phase detector with square-wave input.

(b) *Theory for Square-Wave Input.*

By considering Figs. 11 and 15 we can find the result of applying rectangular waves to the circuit of Fig. 14.

If ϕ is negative, $\left(\frac{\pi}{2} - \phi\right)$ is greater than $(\pi/2 + \phi)$, and hence the time duration of the pulses applied to G_1 are greater than those applied to G_4. Hence the capacitor C_2 will acquire a steady voltage V_A such that X is positive in potential to Y.

If R_2 is very much greater than R_1, the voltage V_A must satisfy the following equation, taken over one complete cycle,

$$\frac{(V_1 - V_A)(\pi/2 - \phi)}{R_1} = \frac{V_A\left(2\pi - \frac{\pi}{2} - \phi\right) + V_1(\pi/2 + \phi)}{R_1} \quad (22)$$

Which reduces to,

$$\frac{V_A}{V_1} = \frac{-\phi}{\pi - \phi} \quad .. \quad .. \quad .. \quad (23)$$

This equation is exact for values of ϕ from 0 to $-\pi/2$.

For values of ϕ from 0 to $\pi/2$, Y becomes positive in potential to X and the equation should read,

$$\frac{V_A}{V_1} = \frac{\phi}{\pi + \phi} \quad \ldots \quad \ldots \quad \ldots \quad (24)$$

The complete curve is shown in Fig. 18.

If the resistance R_2 is not so small that it may be neglected, equation (22) should be written,

$$\frac{(V_1 - V_A)(\pi/2 - \phi)}{R_1}$$

$$= \frac{V_A(2\pi - \pi/2 - \phi) + V_1(\pi/2 + \phi)}{R_1} + \frac{2\pi V_A}{R_2} \ldots (25)$$

which reduces to,

$$\frac{V_A}{V_1} = \frac{-\phi}{\pi(1 + R_1/R_2) - \phi} \quad \ldots \quad \ldots \quad (26)$$

The measured response on a circuit made up with the values $R_1 = 5{,}000$ ohms and $R_2 = 22{,}000$ ohms is also plotted in Fig. 18.

Conclusion

The simple push-pull and the balanced push-pull phase detectors with sinusoidal and square-wave input have been analysed. Reviewing the results it would appear that for the overall requirements of sensitivity and a reasonably linear relation between phase difference and output, the simple push-pull detector with square-wave input gives the best result. The simple push-pull detector with sinusoidal input is more sensitive but the relationship between ϕ and the output voltage is sinusoidal, which may be undesirable.

REFERENCE

1. "Methods and Apparatus for Measuring Phase Distortion." M. Levy. *Electrical Communications*, Jan. 1940.

World List of Scientific Periodicals

A third edition of this reference book is being prepared to include all scientific and technical periodicals that have appeared from 1900 to 1947. Librarians are asked to co-operate by sending particulars of all journals which do not appear in the second edition to the Secretary, World List of Scientific Periodicals, c/o The Zoological Society of London, Regents Park, London, N.W.8.

BOOKS

Uber Frequenzmodulatoren für Ultrahochfrequenz.

By Georg Weber. Pp. 95 with 35 Figs. Published by Verlag AG. Gebr. Leemann & Co., Zürich. Price 9 Francs (Swiss).

This represents the thesis presented by the author for the D.Sc. degree at the Zürich Technische Hochschule. The work was carried out in the Institut für Hochfrequenztechnik under the direction of Dr. F. Tank. It deals with the difficulties of applying frequency modulation to transmitters working at frequencies of 100 to 600 Mc/s. Of the five chapters the first three discuss the problem and the last two describe the construction of apparatus and the measurements made with it. The relative merits of amplitude and frequency modulation are discussed in the opening chapter. The second chapter deals with the variable impedance valve, and the use of a klystron for this purpose. Chapter 3 is divided into two parts dealing with two different types of mechanical modulators, viz., piezoelectric and electrostatic modulators. The latter is then chosen and the remainder of the book describes in detail the construction and testing of an electrostatic frequency modulator. By means of the movement of a membrane the capacitance of a cavity resonator in the u.h.f. system is varied, thus causing the frequency to vary. The membrane is moved electrostatically by means of a metal plate parallel to it, the two forming an air capacitor, the voltage of which is varied by the modulating valve.

The results obtained are considered satisfactory. The question of distortion is discussed, and also the question as to the number of channels that can be utilized within a given frequency band in view of the large band of frequencies involved in a frequency-modulated transmission. The book is well worth careful study by anyone interested in this branch of the subject.

G. W. O. H.

The Magnetron

The object of this note is to draw attention to the April number of the *Bell System Technical Journal*, Vol. XXV, No. 2. Although published as a monthly issue of the Journal, it may well be regarded as a textbook on the magnetron, for it contains only one article, "The Magnetron as a Generator of Centimetre Waves." The authors are Fisk, Hagstrum, and Hartman, all of whom were engaged in the Electronics Research Department on magnetron development during the war. The article occupies 180 pages and has 80 figures, including many excellent photographs. Extra copies can be obtained at 1 dollar per copy from the American Telephone and Telegraph Co., 195 Broadway, New York. Although nominally the April number, circumstances delayed its publication until July. It is an outstanding publication, and it can be strongly recommended, notwithstanding the fact that the authors use the same abbreviation *m* for both milli- and mega-.

G. W. O. H.

CORRESPONDENCE

Letters of technical interest are always welcome. In publishing such communications the Editors do not necessarily endorse any technical or general statements which they may contain.

Response of Oscillator to External E.M.F.

To the Editor, "Wireless Engineer"

SIR,—In his article "Oscillator Power Relations" in the September 1946 issue of *Wireless Engineer*, Mr. R. E. Burgess includes a section discussing the response of an oscillator to an external e.m.f. injected into its circuit. The brevity of treatment of this section is such that I cannot myself fully follow it, and the section also seems irrelevant to the article; but these are personal matters. My present object is to point out what seems to me to be a fallacious argument; I suggest that it is not possible to consider the effective "half-power" bandwidth of the system, nor to express it in terms of a linear tuned circuit.

Mr. Burgess specifies the external (or injected) frequency to be different from the oscillation frequency. Yet he deduces the bandwidth between the points where the response is 3 db below that at midband, even though the response at midband (i.e., at the natural oscillation frequency) is specifically excluded from his analysis! Moreover, he specifies that the injected e.m.f. is small so that U (the voltage across the oscillator due to the injected frequency ω) is small compared with A (the voltage across the oscillator due to the free oscillation of frequency ω_0). This requirement appears to me to exclude consideration of any frequency near the "3-db pass-band," because at any frequency so close to the natural frequency, the injected e.m.f. would need to be almost infinitesimal to avoid making U comparable with A.

No mention is made by Mr. Burgess of synchronization, the well-known phenomenon of suppression of the free oscillation by the forced oscillation. This occurs when $\omega \sim \omega_0$ is sufficiently small in relation to the amplitudes in the circuit. Mr. Burgess gives Appleton's paper[1] of 1922 as one of his references in spite of ignoring the effect in his text. This paper discusses some aspects of synchronization, and a more comprehensive treatment will be found in my own more recent paper.[2] This matter is vital to Mr. Burgess's problem, as I hope to show below.

Using the methods, results and symbols of my paper, in which

$\hat{e}_i \sin \omega t$ is the fundamental component of the forced oscillation voltage across the input to the non-linear maintaining circuit,

$\hat{e}_s \sin \omega t$ is the injected voltage,

$\hat{e}_{io} \sin \omega_0 t$ is the natural oscillation voltage with no injected signal,

$G(e_i)$ is the non-linear amplification of the maintaining circuit to fundamental frequencies,

and putting $\hat{e}_{im}$ for the peak amplitude of the forced oscillation when $\omega = \omega_0$ and using the subscript p for values associated with the pull-out point, or point of failure of synchronization, we can proceed as follows:—

If the injected voltage is small, then just at the point where synchronization is about to fail, and a free oscillation about to start, we have the relation

$$\frac{\hat{e}_{ip}}{\hat{e}_s} = \frac{1}{2Q\left(1 - \frac{\omega_p}{\omega_0}\right)}$$

and under such conditions, $\hat{e}_{ip}$ is only slightly smaller than $\hat{e}_{io}$.

When $\omega = \omega_0$, then $\hat{e}_i$ has the value of $\hat{e}_{im}$ and $\hat{e}_{im} > \hat{e}_{io}$ always. We have now the relation

$$\frac{\hat{e}_{im}}{\hat{e}_s} = \frac{1}{1 - G_m(e_i)}$$

where $G_m(e_i)$ is the gain of the maintaining circuit for the amplitude $\hat{e}_{im}$.

When free oscillation occurs in the absence of an injected signal, $G_o(e_i) = 1$, and since $\hat{e}_{im} > \hat{e}_{io}$ and the non-linearity must be such as to reduce the gain for an increased amplitude, we have $G_m(e_i) < 1$. Thus, for a given injected voltage $\hat{e}_s$, the change in response between frequencies ω_o and ω_p is given by

$$\frac{\hat{e}_{im}}{\hat{e}_{ip}} = \frac{2Q\left(1 - \frac{\omega_p}{\omega_o}\right)}{1 - G_m(e_i)}$$

This may be greater or less than 3 db according to the actual values of Q, $\hat{e}_s$ (which determines ω_p/ω_o), and $G(_{ei})$. In an average case it will be greater than 3 db; e.g., Fig. 11 in my paper shows that for $G(_{ei}) = 1.03 - 0.12\hat{e}_i^2$ (which gives $\hat{e}_{io} = 0.5$), $\hat{e}_s = 0.05$ and $Q = 80$, the output of forced oscillation at pull-out is approximately 4 db below that at "midband."

We can thus conclude that the 3-db bandwidth (if it has any meaning at all) will generally occur within the synchronizing frequency range, which is not discussed by Mr. Burgess, and is implicitly excluded from his analysis by his requirement $U \ll A$. Evidently the response cannot be expressed in terms of a fixed effective Q, because for a constant value of injected voltage, the forced oscillation amplitude varies with frequency, so that the non-linear factor (considered by Mr. Burgess as a parallel negative conductance) varies with frequency.

It is clear, I think, that Mr. Burgess's discussion is, to say the least, somewhat misleading. There is no opportunity to give the matter a full analysis on my part here, but I would claim that it is more readily treated by the methods used in my paper[2] than by Mr. Burgess's method.

Amersham, Bucks. D. G. TUCKER.

REFERENCES

1 E. V. Appleton, "The Automatic Synchronization of Valve Oscillators," *Proc. Camb. Phil. Soc.*, 1922-3, Vol. 21, p. 231-248.

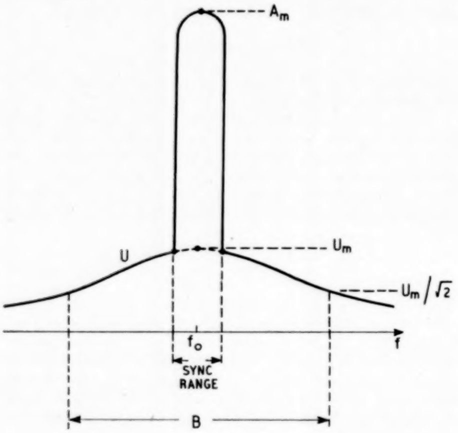
2 D. G. Tucker, "Forced Oscillations in Oscillator Circuits, and the Synchronization of Oscillators," *J.I.E.E.*, 1945, Vol. 92, Part III, p. 226-234.

To the Editor, "Wireless Engineer."

SIR,—Dr. Tucker's criticism springs from a misunderstanding which may well have arisen from the admitted brevity of section 6 of my paper.

The response curve defined by equation (19) relates the amplitude U of the forced oscillation to that of the injected e.m.f. E whose frequency is different from the oscillation frequency. It is specifically stated in my paper that E is sufficiently small for $U \ll A$ where A is the amplitude of the free oscillation and the synchronization range is correspondingly very small; ω is naturally assumed to lie *outside* the synchronization range in order that both the free and forced vibrations are present in the form given by equation (17).

The "3-db bandwidth" derived from equation (19) is referred to the value U_m obtained at f_0 by extrapolating the U, f curve through the synchronization range and *not* to the value A_m of the oscillation at f_0. The figure (not to scale) illustrates this point: B is reckoned between the points where $U = U_m/\sqrt{2}$ and not $A_m/\sqrt{2}$.



R. E. BURGESS.

National Physical Laboratory,
Teddington, Middx.

Transient Response of Filters.

To the Editor, "Wireless Engineer."

SIR,—I have read with interest Mr. C. C. Eaglesfield's short article on this subject in the November 1946 issue of *Wireless Engineer*, and am duly impressed by the neat and elegant way in which he solves the filter build-up equation which I found so difficult in my article in the March 1946 issue. I would like to point out, however, that I did give values for the coefficient G, based on the analogous low-pass filter, and these values were determined from exactly the same formula as Mr. Eaglesfield derives; this is easily seen from the figures I gave. My difficulty at this stage was that the calculated values did not fit the measured responses; and I suggested the reason was probably the effect of dissipation, since the Q-value of the inductors was only 100, which gives Qn (the factor affecting response, corresponding to Q in a low-pass filter—see my earlier article in the February 1945 issue) of only 3.7. I think Mr. Eaglesfield has rather overlooked the fact that I had dealt with these points.

D. G. TUCKER.

Amersham, Bucks.

Is Rotation Relative or Absolute?

To the Editor, "Wireless Engineer"

SIR,—In your editorial of the October issue, I found many controversial statements. They seemed to contradict entirely many experiences of the physical world. Therefore may I submit a few ideas on the subject "Is rotation relative or absolute"?

In order that we may possess a framework on which to build the argument it is necessary to state those things which we can regard as axiomatic.

1. The medium of events is "free space," which does not restrict those events.

2. An observer, in space, is capable of making time measurements.

3. The observer regards himself as stationary, when not acted upon by any force. If acted upon by a force he regards himself as moving with an acceleration in the direction of that force.

4. Distance is to be measured in absolute space.

5. A line is uniquely determined by two points in space.

6. The angle between two lines is to be regarded as some measure of the variation in distance between pairs of points on the lines, which are members of ordered aggregates of points in one-one correspondence, on these lines.

Having made these preliminary remarks, let us now consider what is meant by motion. The motion of a body infers change of position with time. To establish position we can erect two different systems of coordinates, either the Cartesian system or the polar system. To simplify the argument let us limit the discussion to a plane. Both these coordinate systems require two lines to establish the position of a point in a plane and therefore, in general require three points, including the datum point of the observer. In the case of polar coordinates, the position itself is regarded as one of the three points. In this last case, position is defined by the distance between the point and the pole, and the angle between the initial line and the line through the pole and the given point. Variation of either or both of these quantities with time will be sufficient to establish motion.

Let us now attempt a definition of rotation as applied to a finite body of zero thickness, in the plane of the coordinate system.

Suppose the observer at the datum point, draws a line across the body. He will note that this line makes different angles with the mean direction of the body as time progresses. Eventually by a series of observations he will determine the axis of rotation, which will seem to be stationary to him.

Having fixed this axis, the rotation of the body can be defined as a change in the angle between the line joining the datum point with the axis and the line joining the axis to any other point on the body, with time. Note that if no such point can be observed, the rotation of the body will not be visible.

Suppose now, the observer is fixed at the end of some extended radius of the body, which rotates. The observer will note that the angle subtended at the centre by every point is invariant with respect to time. He therefore concludes that the body is not rotating, although he is experiencing a force directed along the radius and towards the axis of rotation. He will conclude an acceleration towards the axis.

Now consider the case where the observer is situated at the axis of rotation. He will not be subject to any radial force. Unless there exists a point, external to the body, which is not subject to a radial force, he will not be able to erect the two lines by which rotation can be detected, since every two lines within the body will intersect at angles invariant with time. If however such an external point exists, the observer will conclude that it is rotating about him, by erecting a datum line on the body and another from himself to the external point.

We may therefore make the following generalizations:

(i) To any observer anywhere on the plane with relation to the axis of rotation of the body, the rotation will be detectable, provided the observer is not subject to the same radial force as he would be if he were attached to a fixed infinite radius of the body.

(ii) To any observer anywhere on the plane of the body, and "attached" to the radius of the body passing through his datum point, rotation will *not* be visible.

Therefore it is concluded that rotation is relative to the observer.

B. A. Hunn, Capt. R.E.M.E.

London, S.W.1.

To the Editor, The Wireless Engineer

Sir,—Your Editorial slyly shifts the absolute quality from the rotation of the body to the non-rotation of the observer. It is necessary to regard an observer who is "on" or "at rest relative to" a body as one whose sole frame of reference is in completely fixed relationship to the body in question; but you reject this definition in your footnote and adopt another definition which in fact makes the rotation of the cylinder become relative to the line joining the observer and the distant point on which he keeps his eye constantly fixed.

The fact which has some appearance of making the observer conscious of rotation is not the relative motion of certain points but the need for a constant force to maintain a central acceleration, just as with the revolving magnet the force on a neighbouring charge is the crucial issue. The trouble then is that a rotating body has an *acceleration*, and while we have become accustomed to the special theory of relativity, which applies to systems with constant relative velocity, transformations between systems having relative accelerations come under the general theory of relativity which is beyond the range of engineers' mathematics. However, it is concerned with this very problem of the invariance of forces when referred to different co-ordinate systems, and the general theory of relativity should not be ignored even if we do not understand its details.

D. A. Bell

London, N.21.

Class-B Amplifiers

To the Editor, The Wireless Engineer

Sir,—In your October correspondence columns Dr. Sturley has described an interesting method of calculating approximately the relation between the peak and mean currents in Class-B amplifier valves with sinusoidal grid excitation. The basic assumption in Dr. Sturley's analysis, namely, that the anode current becomes zero whenever the alternating component of the grid voltage becomes negative, may also be used to calculate approximately the peak and mean currents and the anode dissipation for grid voltages of arbitrary waveform, e.g. speech waves, if the crest factor, C (= peak/r.m.s.), and the form factor, F (= r.m.s./arithmetic mean), are known.

Let I_o = anode current in the absence of grid excitation

I_p = peak anode current with grid excitation

When the alternating grid voltage is positive the mean anode current is $I_o + (I_p - I_o)/CF$, and when the alternating grid voltage is negative the anode current is zero. It is further assumed that positive and negative values of grid voltage are equally probable. The mean anode current over both positive and negative values of grid voltage is then

$$I_a = I_o/2 + (I_p - I_o)/2CF$$

Suppose that two valves are used in a push-pull amplifier with an h.t. voltage V_a, and an anode-to-anode load which is a resistance R at all the frequencies concerned, and is zero for d.c. With grid excitation the peak current in the load is $I_p/2$, and the load-current waveform may be taken as a first approximation to be the same as the grid voltage waveform. Let V_{min} be the minimum value reached by the anode voltage, then $R = 4(V_a - V_{min})/I_p$, and the power absorbed by the load is $RI_p^2/4C^2$. The total power supplied by the h.t. source is $2V_aI_a$, whence the anode dissipation in each valve is

$$V_aI_a - RI_p^2/8C^2$$
$$= V_aI_o/2 + V_a(I_p - I_o)/2CF - I_p(V_a - V_{min})/2C^2.$$

For sine waves $C = \sqrt{2}$ and $F = \pi/2\sqrt{2}$. For speech waves $F = 2$. The value of C is somewhat indeterminate and may depend on the amount of peak limiting or permissible distortion, but a value of 5 may be taken as representative for most applications.

The formulae given above are approximate, and the accuracy decreases as the product CF increases, but they have been found useful in making the first attempt at a design.

A. S. G. Gladwin

University of London,
King's College.

BRITISH I.R.E.

The 21st birthday of the British Institution of Radio Engineers was celebrated by a dinner at the Savoy Hotel on 31st October, 1946. Admiral the Viscount Mountbatten of Burma replied to the toast of the President proposed by the immediate past President, Mr. Leslie McMichael.

The Institution has grown out of the Institution of Wireless Technology which was formed in 1925, its present title being taken on the fusion of the original institution with the Institute of Radio Engineers in 1942.

Precision Instruments

A new catalogue of precision apparatus for electrical standards for research and industry has been produced by H. W. Sullivan, Ltd., London, S.E.15. Of 200 pages, it contains detailed descriptions and characteristics of apparatus ranging from fixed and variable standard capacitors and inductors to bridge and frequency-standard oscillators.

WIRELESS PATENTS

A Summary of Recently Accepted Specifications

The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each.

ACOUSTICS AND AUDIO-FREQUENCY CIRCUITS AND APPARATUS

577 333.—Spring guiding-member for clamping and controlling the vibration of a loudspeaker diaphragm.

D. Eklöv. Convention date (Sweden), 16th December, 1942.

577 358. — Loudspeaker in which the main diaphragm is coupled to an auxiliary system of elastically-mounted massive elements, to prevent resonance effects.

The British Thomson-Houston Co., Ltd. Convention date (U.S.A.), 7th January, 1943.

DIRECTIONAL AND NAVIGATIONAL SYSTEMS

577 242.—Radio installation for training operators on a grounded aeroplane in the art of radio-navigation and blind-landing.

Link Aviation Devices Inc. Convention date (U.S.A.) 29th April, 1942.

577 269.—Rotary-disc switching device for alternate transmission and reception, through waveguide couplings, say in radiolocation equipment

Marconi's W.T. Co. Ltd. (assignees of G. W. Leck). Convention date (U.S.A.) 25th May, 1943.

577 275.—Time-storage or integrating devices, used in combination with a c. r. tube, for reducing interference in the observation of "repetitive" signals, such as are used in radiolocation.

W. S. Percival. Application date 30th November, 1939.

577 276.—Blind-landing system in which a glide-path of constant field-strength approaches ground at a point remote from the transmitting aerials.

Standard Telephones and Cables Ltd., C. W. Earp and G. G. Samson. Application date 23rd February, 1940.

577 285.—Coupling network for transforming, without distortion, the output from the constantly-rotating search-coil of a radio goniometer to an amplifier feeding a c. r. indicator.

Standard Telephones and Cables Ltd. (assignees of H. G. Busignies). Convention date (U.S.A.) 6th March, 1941.

RECEIVING CIRCUITS AND APPARATUS

577 240.—Cathode-ray tube for monitoring, or indicating the beginning and end and operating-frequency, of one or more radio transmitters.

H. A. M. Clark. Application date 20th June, 1941.

577 247.—Diversity-reception system, for reducing the effect of selective fading, and applicable to frequency-modulation signals.

S. G. Dehn (communicated by Press Wireless Inc.). Application date, 13th April, 1944.

577 345.—Radio-operated switch for rendering a distant receiver active for predetermined periods, say for the remote control of firing apparatus.

D. Weighton and Pye Ltd. Application date 15th November, 1940.

577 443.—Radio set in which a rigid metal front panel is fitted with a pair of projecting rails, which can serve either as carrying-handles or as supporting-feet.

G. A. Laughton and H. N. Cox. Application date 27th April, 1944.

577 462.—Coupling network, say between two i.f. amplifiers, to provide a band-pass effect having an adjustable characteristic at frequencies near the middle of the band.

The General Electric Co. and D. C. Espley. Application date 21st May, 1943.

CONSTRUCTION OF ELECTRONIC-DISCHARGE DEVICES

577 278.—Electron-discharge device, for velocity-modulation, in which the bunched electrons are projected on to a secondary-emission electrode.

Standard Telephones and Cables Ltd., J. H. Fremlin, and R. N. Hall. Application date 24th May, 1940.

577 280.—Oscillator or frequency-changing device in which a beam of electrons is subjected to a wave-like deflection as it passes through a static magnetic-field.

The British Thomson-Houston Co. Ltd. Convention date (U.S.A.) 22nd December, 1939.

577 530.—Velocity-modulating tube in which the bunched stream is returned to the resonator along a potential gradient which is set up by a reflecting electrode-system.

A. F. Pearce, N. C. Barford, and B. J. Mayo. Application dates 16th December, 1941, and 13th January, 1943.

SUBSIDIARY APPARATUS AND MATERIALS

577 089.—Preparations of a fine-grain fluorescent material containing cadmium and manganese phosphate, and a mixture of chlorides and phosphates to serve as activators.

Siemens Electric Lamps and Supplies, Ltd. and H. Austin. Application date 24th April, 1944.

577 120.—Arrangement for time-marking, when making photographic records of oscillograph indications over a wide frequency-range.

A. C. Cossor, Ltd. and A. N. Melchior. Application date 19th April, 1944.

577 219.—Shrouded terminal, providing high insulation, particularly for feeding an element which is enclosed in an hermetically-sealed case.

Standard Telephones and Cables Ltd., P. K. Chatterjea, and S. J. Powers. Application date 11th February, 1944.

577 428.—Insulating coating, containing finely-divided anthracite coal, for reducing corona effects in high-voltage conductors.

Westinghouse Electric International Co. Convention date (U.S.A.) 3rd December, 1942.

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement
with the Department of Scientific and Industrial Research

In order to enhance the usefulness of the abstracts, certain changes have been made in their presentation. The subject sections have been increased in number and made more in accordance with the modern trend of development, and they are now arranged in alphabetical order. Universal Decimal Classification numbers have been added to each abstract, and heavy-face type has been adopted for the serial number and title in order to increase their legibility.

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ACOUSTICS AND AUDIO FREQUENCIES

534.851 : 621.395.625.2 **1**

On the Playback Loss in the Reproduction of Phonograph Records.—O. Kornei. (*J. Soc. Mot. Pict. Engrs*, Dec. 1941, Vol. 37, No. 6, pp. 569–590.) An analysis of the loss in the upper frequency range in reproducing lateral-cut records due to the elastic properties of the record material for the case of a spherically-pointed stylus. The playback loss (difference between recorded and reproduced level at any point) is independent of record amplitude and may be positive, zero or negative. The translation loss (difference between playback losses at two points) can only be made zero in systems with constant groove velocity; in standard recordings this is impossible, but the stylus mass can be chosen to give a compromise between translation loss and signal/noise ratio.

534.862 **2**

Multiple-Speaker Reproducing Systems for Motion Pictures.—H. I. Reiskind. (*J. Soc. Mot. Pict. Engrs*, Aug. 1941, Vol. 37, No. 2, pp. 154–163.) Systems employing extra loudspeakers outside the screen, while undesirable for dialogue, are advantageous for realistic reproduction of music and sound effects. A commercially practicable arrangement is described, in which a variable-width sprocket-hole control-track on the print is scanned by a simple photo-cell system, amplitude variations of the output of which control the operation and volume of the extra speakers. See also 3.

534.862 **3**

Vitasound [realistic cinema reproduction].—N. Levinson & L. T. Goldsmith. (*J. Soc. Mot. Pict. Engrs*, Aug. 1941, Vol. 37, No. 2, pp. 147–152.) A variable-width control track is printed in the sprocket-hole area of the standard film, and scanned by a separate photocell. This operates a variable-gain sound amplifier over a range of 10 db, and also a loudspeaker switching relay for extending the source of sound to loudspeakers beyond the screen. Both units have self-contained voltage-stabilised power supplies. The operating time of the control equipment is 60 ms, which is fast enough to deal with short duration effects. See also 2.

534.862 **4**

The Stereophonic Sound-Film System—General Theory.—H. Fletcher. (*J. Soc. Mot. Pict. Engrs*, Oct. 1941, Vol. 37, No. 4, pp. 331–352.) The ideal recording reproducing system for a typical hall is discussed. Intensity and frequency range curves are given. The modifications to these caused by room noises are considered in detail. Three-channel recording is used to give good representation of movement on a large stage and allows the use of the central channel for solo work if required. Reasons for variable area rather than variable density recording are given.

A volume range of 80 db has to be compressed to 50 db due to film limitation. Ideal relationships between signal input and compressor gain are deduced from signal/noise considerations to be constant gain for the first 50 db and gain inversely proportional to input for the remaining 30 db. The necessity for a pilot channel to control gain is demonstrated. The single pilot channel controls all three signal channels. Each signal channel is associated with a frequency from a magnetic tone-generator, the amplitude of which is controlled by the level of sound in that channel.

534.862 **5**

Mechanical and Optical Equipment for the Stereophonic Sound-Film System.—E. C. Wente, R. Biddulph, L. A. Elmer & A. B. Anderson.

(*J. Soc. Mot. Pict. Engrs*, Oct. 1941, Vol. 37, No. 4, pp. 353–365.) The same mechanical system is used for recording and reproduction. Special care is taken to ensure uniform film velocity by using a new type of internally-damped roller.

The 3 signal and the pilot channels are recorded simultaneously by light valves. During reproduction the light is guided to the photocells by glass rods.

534.862 **6**

Fantasound [stereophonic system used in "Fantasia"].—W. E. Garity & J. N. A. Hawkins. (*J. Soc. Mot. Pict. Engrs*, Aug. 1941, Vol. 37, No. 2, pp. 127–146.) The system uses three sound tracks and a control track carrying three tones which vary the gains of the three programme channels. A differential junction network is used for giving apparent motion of a sound source across the screen. Ten versions of the system are described in historical order of development. The technique of scoring and dubbing is also described.

534.862 : 621.395.665 **7**

An Improved Mixer Potentiometer.—K. B. Lambert. (*J. Soc. Mot. Pict. Engrs*, Sept. 1941, Vol. 37, No. 3, pp. 283–288, Discussion, pp. 289–291.) A mixer comprising five plug-in units of two mixer controls each. The mixer potentiometer controls move linearly, in parallel grooves, so that all ten can be handled simultaneously by one operator. Incoming channels, attenuated as desired (over a range of 6–105 db) by the potentiometers are combined by special transformers in groups of four, into an output having the same impedance as each (200Ω). The potentiometers are continuously wire-wound, and themselves have approximately constant input and output impedances of 200Ω. Internal crosstalk between channels is less than − 110 db.

534.862.3 : 621.395.625.6 **8**

A Light-Valve for the Stereophonic Sound-Film System.—E. C. Wente & R. Biddulph. (*J. Soc. Mot. Pict. Engrs*, Oct. 1941, Vol. 37, No. 4, pp. 397–405.) The theory of light valves for sound recording on film is discussed and a mechanically robust design described. A pair of coplanar duralumin ribbons 0.004 inch apart are supported in a transverse magnetic field of 32 000 Gauss in the air gap between the conical pole pieces of a permanent magnet. The ribbons form a light slit which varies in size in accordance with the current flowing through them. The chief problem is to obtain uniform response over a wide frequency range including the resonant frequency, since a value of this above the working range would involve impracticable ribbon tension and dimensions. In this case the resonant frequency is 8 400 c/s, and the response/frequency characteristic has a broad maximum around 8 000 c/s, 5 db above the response at low frequencies. Uniform overall response in the band 30–14 000 c/s is obtained by suitable electrical networks. Large electromagnetic damping of the ribbons is used to assist in this and also to minimise the effect of free oscillations at the resonant frequency, produced by the ribbons striking each other. The built-in optical system consists of a condensing lens focusing the light source in the plane of the ribbons, and a microscope objective focusing the ribbons on the film.

534.862.3 : 621.395.665.1 **9**

Electrical Equipment for the Stereophonic Sound-Film System.—W. B. Snow & A. R. Soffel. (*J. Soc. Mot. Pict. Engrs*, Oct. 1941, Vol. 37, No. 4, pp. 380–395, Discussion pp. 395–396.) For the recording of symphonic music. Film noise reduced by pre-equalisation rising to 18 db above 8 000 c/s, and automatic compression and expansion of 30 db. Overall "air-to-air" response of system including microphone amplifier and loudspeaker is substantially uniform from 40 to 15 000 c/s. The compandor system has a uniform frequency characteristic and is pilot-operated by a tone channel.

534.862 : 621.396.665.1 **10**

The Stereophonic Sound-Film System—Pre- and Post-Equalization of Compandor Systems.—J. C. Steinberg. (*J. Soc. Mot. Pict. Engrs*, Oct. 1941, Vol. 37, No. 4, pp. 366–379.) Curves give as a function of frequency the reduction in film noise that is required to reproduce the original intensity range. This is greatest at the higher frequencies where 43 db improvement in signal/noise is required. The use of a suitable equaliser reduces this figure to a maximum of 30 db, which is within the range of a compandor, even with a 15 db "enhancement" feature. The practical performance of the compandor is given, with the results of its use in conjunction with equalisers..

621.314.2 **11**

High-Quality Communication and Power Transformers.—Harrison. (*See* 201.)

621.317.353 **12**

A Simple Method of Measuring Distortion in A.F. Oscillators and Amplifiers.—Smith. (*See* 117.)

621.395.47 **13**

Inverted Speech.—A. W. Ladner. (*Marconi Rev.*, Jan./Mar. 1945, Vol. 8, No. 76, pp. 32–35.) Second part of an article dealing with the relationship of inverted speech to ordinary articulatory sounds. Tests are described in which single-syllable words were inverted at 1 500 c/s and recognition by a group of listeners examined. The majority of vowels and consonants become unrecognisable on inversion and the reason for this is illustrated in terms of the energy/frequency spectrum. For first part see 78 of 1945.

621.395.614 **14**

Piezo-Electric Microphones.—W. T. C. (*Wireless World*, Nov. 1945, Vol. 51, No. 11, pp. 345–346.) If mounted in a light-weight container the piezo-electric microphone is very sensitive to noise caused by handling and vibration, and exhibits large resonances. The article shows the design of a heavy metal case in which the performance is greatly improved.

621.395.623 **15**

High-Fidelity Headphones.—L. J. Anderson. (*J. Soc. Mot. Pict. Engrs*, Sept. 1941, Vol. 37, No. 3, pp. 319–323.) The acoustic properties of the moving-coil earpieces are treated in terms of the equivalent electrical circuit. Low-frequency response is improved by the reduction of leakage past the ear-cap as revealed by a smoke test, as well as by adjusting circuit constants. Mechanical requirements are considered and performance curves given.

621.395.623.7 **16**

The Duplex Loudspeaker.—J. B. Lansing. (*J. Soc. Mot. Pict. Engrs,* Sept. 1944, Vol. 43, No. 3, pp. 168–173.) A two-way loudspeaker for 25 W input with a high-frequency horn mounted on the face of the low-frequency diaphragm. Dividing networks are given for cross-over at 1 200 c/s. Gives efficient radiation beyond 15 000 c/s with low intermodulation products. High-frequency horn has an angle of radiation of 60° horizontally and 40° vertically.

621.395.623.8 **17**

Acoustic Feedback Reduction by Increased Directivity in Electric Megaphones.—A. J. Sanial. (*Communications,* Sept. 1945, Vol. 25, No. 9, pp. 62–64.) Acoustic feedback from loudspeaker to microphone is reduced by partially focusing the sound by means of a ring exit surrounded by a slightly divergent outer horn, with an inner plug. Some three times increase in pressure-output over the annular horn has been obtained. A continuation of 3556 of 1945.

621.395.625 : 621 **18**

It Pays to Listen.—(*Sci. Amer.,* July 1945, Vol. 173, No. 1, pp. 18–20.) Imperfections in running machinery can often be detected by a change in the characteristic noise earlier than by any other method. With modern quiet-running machinery the sounds can be amplified and recorded, and compared at any time with a standard recording made when the machinery was running well.

621.395.625.2 + 621.395.625.6 **19**

Western Electric Recording System—U.S. Naval Photographic Science Laboratory.—R. O. Strock & E. A. Dickinson. (*J. Soc. Mot. Pict. Engrs,* Dec. 1944, Vol. 43, No. 6, pp. 379–404.) A general technical description of a commercial recording and re-recording equipment using film and disk. Improved designs for ease of operation and servicing.

621.395.625.2 **20**

Glossary of Disk-Recording Terms.—H. A. Chinn. (*Proc. Inst. Radio Engrs, N.Y.,* Nov. 1945, Vol. 33, No. 11, pp. 760–763.) About 120 terms, all pertaining to constant-rotational-speed disc recording.

621.395.625.2 **21**

Analytic Treatment of Tracking Error and Notes on Optimal Pick-Up Design.—H. G. Baerwald. (*J. Soc. Mot. Pict. Engrs,* Dec. 1941, Vol. 37, No. 6, pp. 591–622.) An analysis of the non-linear distortions due to tracking error in the reproduction of lateral-cut disc recordings. For a sinusoidal signal the analysis is the same as that arising in Bessel's solution of planetary motion. The harmonic distortion for both sinusoidal and complex signals is discussed. The emphasis of the high-frequency components increases the nuisance value of the distortion, which is greater than is commonly assumed.

Pick-up design for minimum tracking distortion over the whole playing range is considered. In straight arms the underhang is adjustable, while in offset arms the offset angle and overhang are adjustable and they are superior to straight arms, enabling tracking distortion to be rendered negligible even under adverse conditions.

621.395.625.6 **22**

A Re-Recording Console, Associated Circuits, and Constant B Equalizers.—W. C. Miller & H. R. Kimball. (*J. Soc. Mot. Pict. Engrs,* Sept. 1944, Vol. 43, No. 3, pp. 187–205.) Metro Goldwyn Mayer studio equipment with constant resistance multi-channel mixing transformers and variable equaliser circuits. Design formulae are given for a bridged-T equaliser network having adjustable resonant frequency with variable loss or gain at that frequency.

621.395.625.6 **23**

A New Mobile [film sound] **Recording Unit for Studio and Location Work.**—J. L. Fields. (*J. Soc. Mot. Pict. Engrs,* July 1944, Vol. 43, No. 1, pp. 51–58.) A battery-operated unit for a medium-sized van. Aisle-type construction permits flexibility in arrangement of apparatus.

621.395.625.6 **24**

Noise-reduction Anticipation Circuits.—J. G. Frayne. (*J. Soc. Mot. Pict. Engrs,* Nov. 1944, Vol. 43, No. 5, pp. 313–320.) The mean illumination in recording a film sound track is controlled by the output from a microphone placed 10 ft. nearer the sound source than the recording microphone. For re-recording a wax record is used with the pick-up advanced in the groove.

621.395.625.6 **25**

An AAF Portable Sound Recording Unit.—F. T. Dyke. (*J. Soc. Mot. Pict. Engrs,* Nov. 1944, Vol. 43, No. 5, pp. 327–333.) An outline of a commercial equipment suitable for a.c. mains or 36 V battery operation, easily carried in a small vehicle.

621.395.667 **26**

"A New Versatile Tone Control Circuit."—D. Winget. (*Wireless World,* June 1945, Vol. 51, No. 6, p. 182.) A modification of the circuit given in 1840 of 1945.

AERIALS AND TRANSMISSION LINES

621.315.212.1 : 621.317.33 **27**

Coaxial Cable Tests.—Ware. (*See* 114.)

621.315.616 : 621.315.212 **28**

Polyethylene-Disk Insulators for Coaxials.—C. Kreisher. (*Bell Lab. Rec.,* Sept. 1945, Vol. 23, No. 9, pp. 321–324.) The replacement of hard rubber disk insulators in coaxial cables by polyethylene has reduced losses to one-twelfth at frequencies of the order of 1 Mc/s. The manufacturing technique has been slightly modified to suit the newer dielectric.

621.316.99 **29**

Grounding Principles and Practice, I.—Fundamental Considerations on Ground Currents.—R. Rüdenberg. (*Elect. Engng,* Jan. 1945, Vol. 64, No. 1, pp. 1–13.) An analysis of the behaviour of earth currents as influenced by soil resistivity, current frequency, and size and shape of the electrodes. Parts II-V of this five-part series appear in the February-May issues of *Elect. Engng,* and deal with power-engineering aspects of the subject of grounding.

621.392 **30**

The Plane-Wave Resolution of Guided Waves.—S. S. Mackeown & J. W. Miles. (*Proc. Inst. Radio

Engrs, N.Y., Nov. 1945, Vol. 33, No. 11, pp. 805–808.) "Wave propagation in cylindrical guides of both rectangular and circular cross section is treated by representing the proper solutions to Maxwell's equation through a plane-wave expansion of the Hertzian vector. In the case of a rectangular wave guide only a finite number of plane waves (two or four) is required to represent a given mode, while for the circular guide an infinite manifold is required. The plane waves are uniform, travelling with the velocity of light in the medium at an angle to the cylindrical axis which is determined by the frequency and the eigen value of the mode under consideration."

621.392 **31**

The Theory of Transmission Lines.—E. N. Dingley, Jr. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 810–812.) Discussion on 1748 of 1945.

621.392 **32**

The Tapered Transmission Line.—J. W. Milnor. (*Trans. [mon.] Amer. Inst. elect. Engrs*, June 1945, Vol. 64, No. 6, pp. 345–346.) A tapered section of transmission line acts as a transformer, whereby points in a circuit having different impedances may be connected without mismatch. Design formulae are given for exponential taper, lumped taper, and taper of series impedance only.

621.396.67 **33**

Calculating Antenna Radiation Patterns.—H. L. Krauss: R. W. Cronshey. (*Elect. Engng, N.Y.*, Mar. 1945, Vol. 64, No. 3, pp. 131–132.) A correction to the mathematical solution in 798 of 1945 (Cronshey), which does not invalidate the graphical solution. Also Cronshey's reply.

621.396.676.029.54 **34**

Aerials for use on Aircraft: a Comparison between Fixed and Trailing Types on the 900-metre Waveband.—C. B. Bovill. (*J. Instn elect. Engrs*, Part I, Oct. 1945, Vol. 92, No. 58, pp. 397–398.) Summary of 3294 of 1945.

621.396.676.029.62 **35**

A Very-High-Frequency Aircraft Antenna for the Reception of 109-megacycle Localizer Signals.—B. E. Montgomery. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 767–772.) A U-shaped antenna for the frequency band 108.3–110.3 Mc/s is described. The antenna was covered with 3/4 inch of polystyrene to reduce effect of water. Removal of cover changes tuning by 3 Mc/s, causing 9 db reduction in pick-up. The pick-up was uniform to 6 db in all directions, and not more than 10 db below a standard dipole. The aerodynamic drag was 5 lb at 200 m.p.h.

621.396.677 **36**

The Design of Directional Aerial Arrays.—V. J. Cooper & E. Green. (*Marconi Rev.*, Jan./Mar. 1945, Vol. 8, No. 76, pp. 12–23.) Concluding part of article dealing with a method of designing aerial arrays to give predetermined polar curves of field strength. For previous part see 67 of 1945.

CIRCUITS

621.3.011 **37**

The Extended Employment of Thévenin's Theorem.—A. Lee & D. K. C. MacDonald. (*Wireless Engr*, Nov. 1945, Vol. 22, No. 266, pp. 534–537.) Some mathematical examples to show how the theorem can be applied to problems containing transient phenomena.

621.3.011.2 : 621.3.012.3 **38**

Conversion from Series to Parallel Impedance.—G. J. Wheeler. (*Electronics*, Oct. 1945, Vol. 18, No. 10, p. 254.) Shows how a graph consisting of a series of circles, tangential to one axis of a rectangular coordinate system, and with centres on the other axis, can be used to convert series impedances into equivalent parallel impedance combinations. The graph is reproduced.

621.314.12 : 621.383 **39**

A Phototube Amplifier.—J. F. Scully. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 168..184.) Describes a new type of amplifier for the control of industrial equipment by the output of a phototube. Coupling capacitors are eliminated by driving the screen-grid instead of the normal control-grid of the output tube.

621.314.3 **40**

Methods of Applying Negative Feedback—a Reference Chart.—(*Electronic Engng*, Nov. 1945, Vol. 17, No. 213, pp. 770–771.) Seven circuit diagrams show methods of obtaining negative feedback by current and by voltage.

621.314.3 **41**

The Cathode Follower.—"Cathode Ray." (*Wireless World*, Nov. 1945, Vol. 51, No. 11, pp. 322–325.)

621.314.3 **42**

Some Considerations concerning the Internal Impedance of the Cathode Follower.—H. Goldberg. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 778–782.) Analysis of the cathode follower with R in parallel with C for a load. Step-function and sine-wave inputs are considered. The internal impedance is $1/(G_m + G_p)$, where G_m is the grid-plate transconductance and G_p the plate conductance, when the valve is conductive. For step-function input voltages decreasing with time, the conditions for which the tube is conductive are severe. The conductive range is increased by decreasing R, decreasing G_m, or increasing the plate voltage.

621.314.3 **43**

Negative Voltage Feedback.—G. Builder. (*Proc. Instn Radio Engrs, Aust.*, Aug. 1945, Vol. 6, No. 2, pp. 3–6.) Defining the voltage gain of an amplifier as the complex ratio of output to input voltages of the amplifier, and the amplification factor as $(dE_a/dE_g)$for $I_{a\ \text{const.}}$, where E_a is the voltage of the output electrode, E_g is the voltage of the input electrode and I_a is the current to the output electrode, equations are derived for the gain and the output impedance of an amplifier with negative feed-back. These equations are applicable to multi-stage amplifiers with complex loads and may be used in designing feed-back circuits where the fed-back voltage is a definite fraction of the output voltage and contains no other voltages.

621.314.3 : 578.088.7 : 621.396.822 **44**

Biological Amplifiers.—D. H. Parnum. (*Wireless World*, Nov. 1945, Vol. 51, No. 11, p. 342.) Letter discussing noise in biological amplifiers. Flicker

effect increases as frequency is reduced and is immensely greater in coated cathode valves. Writer suggests the use of tungsten filament valves in the first stage of biological amplifiers.

621.314.3 : 578.088.7 **45**

Biological Amplifiers—1.—D. H. Parnum. (*Wireless World,* Nov. 1945, Vol. 51, No. 11, pp. 337–340.) The order of magnitude of voltages encountered in biological work varies from 50 μV to 2 mV at frequencies between 0 and 10 kc/s. The chief difficulties are interference (50 c/s unwanted pick-up), and interaction between several amplifiers connected to one subject. These are both overcome by the use of balanced input stages, push-pull following stages and negative feed-back. Circuit diagrams are shown, and one in particular does not require good insulation to earth, which is very difficult to achieve with human subjects.

621.314.3 : 623.6 **46**

Some Fundamental Considerations in Military Amplifier Design.—Chertok. (*See* 204.)

621.316.313 **47**

Dual A-C Network Calculator.—W. W. Parker. (*Elect. Engng, N.Y.,* May 1945, Vol. 64, No. 5, pp. 182–183.) The calculator network is set up to simulate the electric power system under investigation, and the loads and generator inputs are adjusted to the appropriate values for the specific problem under consideration. The network is then metered, and the readings of volts, watts, and reactive volt-amperes obtained, which give the information required for the system. The calculator is flexible and time-saving: two independent problems can be solved simultaneously.

621.316.721.078.3 **48**

Analysis of Current-Stabilizer Circuits.—W. R. Hill, Jr. (*Proc. Inst. Radio Engrs, N.Y.,* Nov. 1945, Vol. 33, No. 11, pp. 785–792.) "The performance of any current stabilizer can be predicted in terms of two parameters defined as the stabilization transconductance, g_s, and the output conductance, g_o. Together with the equivalent circuits of Figs. 2 and 3 these two factors permit the calculation of the stabilizer performance in conjunction with any load circuit and direct-current supply. Fundamental stabilizer circuits based on the degenerative and mu-bridge principles are developed and analyzed for the two parameters defined. For simple circuits, the analysis suggests the use of pentodes to obtain best stabilization. Superior performance can be obtained by the mu-balance circuit described. This circuit provides an output current substantially independent of any input-voltage or load-circuit change."

621.317.372 : 621.319.4 **49**

Determining Q of Capacitors.—E. L. Pepperberg. (*Electronics,* Sept. 1945, Vol. 18, No. 9, pp. 146, 148.) A chart is given, with a simple calculating procedure whereby the Q of any capacitor may easily be determined from measurement with an ordinary laboratory Q meter.

621.318.572 **50**

Electronic Counting.—M. Weber. (*Communications,* Aug. 1945, Vol. 25, No. 8, pp. 42..98.) A description of a circuit for counting pulses or dividing a frequency. Two condensers and two diodes are connected in such a way that each pulse increases the charge on one of the condensers (see 3961 of 1940). When the potential difference between the condenser terminals reaches a predetermined value a triode blocking-oscillator circuit is triggered, resulting in the production of an output pulse and in the discharge of the condenser. Irregularly-spaced pulses of the same peak amplitude but with different width or shape can be counted, and pulses of irregular amplitude can be counted if a voltage-limiter circuit is used before the counter. A maximum of ten input pulses per output pulse is recommended.

621.318.7 + 621.392.52 **51**

Crystal Filters, Part IV.—R. L. Corke. (*P.O. elect. Engrs' J.,* Oct. 1945, Vol. 38, Part 3, pp. 76–81.) Examples are given of a simple filter with narrow band-pass (0.3%), a lattice filter with wider band-pass (0.6%), and a bridged-T filter suitable for the i.f. section of a receiver. A channel filter of 3 kc/s band-pass and a through-group filter passing frequencies from 60 to 108 kc/s are described. For previous parts see 2930 and 3497 of 1945.

621.318.72 **52**

Abacs for Filter Design.—T. Roddam. (*Wireless World,* Nov. 1945, Vol. 51, No. 11, pp. 332–334.) Two full-page charts from which the values of inductance and capacitance required to design low-pass constant-k,-π or-T section filters can be obtained. The first of a series.

621.385.012.8 **53**

Valve Vectors.—R. G. Wood: D. A. Bell. (*Wireless Engr,* Nov. 1945, Vol. 22, No. 266, pp. 532–533.) Continuation of correspondence on sign conventions. See also 3272 and 3504 of 1945.

621.392 : 621.3.011.2 **54**

Stabilized Negative Impedances—Part III.—E. L. Ginzton. (*Electronics,* Sept. 1945, Vol. 18, No. 9, pp. 140–144.) Applications of negative impedances are described. Elimination of distortion in a diode rectifier can be effected by insertion of a negative resistance shunted across the diode load, the value of this negative resistance being equal to the difference between the impedance offered by the diode output at the modulation frequency and that offered to a d.c. potential difference. Means are also described for eliminating the series resistance of capacitors, producing very large capacitance for power-supply filtering, increasing the Q of tuned circuits, and regulating power supplies. For previous parts see 3268 and 3842 of 1945.

621.392.5/.6 **55**

The Application of the Characteristic Equation of a Matrix to the Evaluation of the Range of Frequencies for which Currents are passed through Networks with Four or More Terminals without Attenuation.—H. V. Lowry. (*Phil. Mag.,* April 1945, Vol. 36, No. 255, pp. 255–264.)

621.392.52 **56**

Effect of Coil Q on Filter Performance.—P. Selgin. (*Communications,* Sept. 1945, Vol. 25, No. 9, pp. 46..106.) Two full-page universal charts from which values of filter components can be obtained. A worked example illustrates the method. See also 3499 of 1945.

621.395.625.6 **57**

A Re-Recording Console, Associated Circuits, and Constant B Equalizers.—Miller & Kimball. (*See* 22.)

621.395.625.6 **58**

Noise-Reduction Anticipation Circuits.—Frayne. (*See* 24.)

621.395.645.211 : 621.395.645.33 **59**

The Resistance-Coupled Amplifier.—L. G. Cowles. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, June Supplement 1945, Vol. 64, pp. 359–365.) "The routine problems of resistance-coupled amplifier design have been simplified and reduced to a set of graphs and convenient conversion charts.

". . . the coupling circuit can be replaced by a pair of equivalent resistance-capacitance circuits so that it is easy to calculate an amplifier's phase and amplitude-frequency characteristics. The design of a coupling circuit to give a specified band width and an acceptable loss has been simplified by the construction of curves of constant band width and peak-frequency loss.

". . . a method and charts are presented for determining without the use of static characteristic curves a suitable operating point, electrode voltages, and plate or screen resistors for any vacuum tube operated class A. As the method given results in the tube being operated with proportionally reduced electrode voltages, its dynamic constants can be extrapolated from values furnished by the manufacturer. Charts facilitating the extrapolation are given.

"A simple transconductance meter for measuring the mutual conductance and circuit transconductance of a tube operated with an external plate resistor is described . . . The gain of the tube and the equivalent plate-circuit resistance can be calculated easily from these two measurements. The dynamic constants μ and r_p can be obtained also with an accuracy sufficient for most practical purposes.

"The methods outlined . . . have proved to be thoroughly practical and reliable in work on a wide variety of resistance-coupled amplifiers."

621.395.665 **60**

Resistive Attenuators, Pads and Networks: Part VIII.—P. B. Wright. (*Communications*, Sept. 1945, Vol. 25, No. 9, pp. 68..80.) An analysis of the series-parallel-connected and of the parallel-series-connected multiple-bridge and lattice-network fader and mixer systems. For previous parts see 2178, 3501 and 3821 of 1945.

621.395.667 **61**

"A New Versatile Tone Control Circuit."—D. Winget. (*Wireless World*, June 1945, Vol. 51, No. 6, p. 182.) A modification of the circuit given in 1840 of 1945.

621.396.615.17 : 621.318.572 **62**

Timing Action of the Blocking Oscillator.—E. Last. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 184..204.) A very full and detailed description of the blocking (or squegging) oscillator, as applied to timing and trigger circuits, and of the means of controlling the characteristics of the output. A two-page article.

621.396.616 **63**

Transmission Lines as Tuning Elements.—H. E. Newell, Jr. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 150, 152.) Describes the theory, construction, and use of a graph for designing a tuning element consisting of a section of transmission line shunted by a capacitor. Values of one or two unknown circuit parameters may be found when values of two or three others are known.

621.396.619 : 621.396.615.17 **64**

Square-Wave [pulse] **Modulator for Signal Generator.**—W. R. Piggott. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 260..268.) Summary of 1536 of 1945.

621.396.66 **65**

Automatic Fader.—D. Hunter. (*Electronics*, Oct. 1945, Vol. 18, No. 10, p. 119.) A description, in very technical language, of a device which automatically fades a broadcast programme in or out, completely or partially, at predetermined rates, without the use of motors. The fading time is adjustable from 1 to 15 seconds, by variation of a time-delayed bias on an amplifier. It operates from "the nemo and announce tally iights plus an installed fade key and tally".

621.396.662.2.029.62 **66**

Coil Design for V.H.F.—A. H. Meyerson. (*Communications*, Sept. 1945, Vol. 25, No. 9, pp. 50..84.) The results of experiments to determine the best coil shape for use at 60–120 Mc/s are given graphically and in tabular form. Coils constructed of round wire, tube, strip, and in disc form were measured and the disc form was found to have the best stability while maintaining a good Q. Single-turn coils of round copper tube had the highest Q, which varied somewhat with tube diameter, but at the highest frequencies the variations between tube and disc type were not significant.

621.397.62 **67**

Restorer-Circuit Operation.—E. Last. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 132–133.) A restorer circuit is a device which shifts the abscissa of an input voltage wave of any form. In a negative restorer a square wave input from 0 to $+ E$ volts will appear as an identical wave from $- E$ to 0 volts; in a positive restorer a wave input from $+ E/2$ to $- E/2$ may be made to appear as a wave from 0 to $+ E$ volts. Biased restoration from $- (E + E_b)$ to $- E_b$ is also possible. The circuits for such devices are described.

621.397.645.31 **68**

Carrier-Frequency Amplifiers: the Unit Step Response of Amplifiers with Single and Double Circuits.—C. C. Eaglesfield. (*Wireless Engr*, Nov. 1945, Vol. 22, No. 266, pp. 523–532.) A mathematical comparison, using Heaviside's operational method, between two amplifiers, one having staggered single circuits and the other double circuits, with a view to finding which has the greater "speed". For the sake of comparison the two amplifiers have the same "overshoot" (see 2283 of 1945). For applications such as in television the two methods are equally effective.

621.3.01/.02 **69**

Elementary Electric Circuit Theory [Book Review].—R. H. Frazier. McGraw-Hill, N.Y., 1945, 414 pp., $4.00. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 428..430.) " . . . intended as a text for electrical engineers who have completed fundamental physics and mathematical courses." " A broad viewpoint of lumped constant circuits . . . written for a first course in circuits."

GENERAL PHYSICS

538.3 **70**

The Application of Newton's Third Law to an Electric Circuit.—G.W.O.H. (*Wireless Engr*, Nov. 1945, Vol. 22, No. 266, pp. 521–522.) The Biot-Savart formula is not a violation of Newton's third law. Analysis of a long, narrow, rectangular loop carrying a steady current illustrates " the fallacy of endowing with separate physical reality the forces on current elements due to other current elements and then discussing whether or not they violate Newton's third law ".

538.3 : 531.51 **71**

A Classical Theory of Electromagnetism and Gravitation.—H. C. Corben. (*Nature, Lond.*, 29th Sept. 1945, Vol. 156, No. 3961, pp. 388–389.)

621.38 **72**

Electronics.—S. R. Cook. (*Sci. Mon., N.Y.*, Aug. 1945, Vol. 61, No. 2, p. 163.) A letter questioning some of the ideas expressed in 3752 of 1945 (Mills).

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.165 + 537.591 **73**

The Composition of the Soft Component of the Cosmic Rays at an Altitude of 3250 m above Sea Level.—A. Alichanow & A. Alichanian. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 2, pp. 73–86.) Cosmic ray measurements by means of counters and ionisation chambers showed a systematic difference between the data obtained by the two methods. " This is due to the presence in the soft component of particles with ionization power exceeding that of the relativistic particles 2.5 to 3.5 times. It is shown that these particles constitute about 20% of the intensity of mesotrons and that they are not connected genetically with the electrons, quanta, or mesotrons and that they are produced by an independent component. . ."

523.165 + 537.591 **74**

Equilibrium Spectrum of the Soft Component of High Energy Cosmic Rays.—A. Migdal. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 2, pp. 87–92.) Numerical calculations for energies several times greater than critical energy.

523.165 : 523.7 : 525.2 **75**

On Currents of Fast Charged Particles induced by Revolving Magnetized Cosmic Bodies.—J. P. Terlezky. (*C.R. Acad. Sci. U.R.S.S.*, 20th April 1945, Vol. 47, No. 2, pp. 101–102.) An electric field is induced around the earth and sun owing to the non-coincidence of their magnetic axes and axes of rotation. This field will accelerate charged particles. The maximum energy attainable in the earth's field due to this cause is 3.10^4eV, and in the sun's field, 2.10^8eV. Similar phenomena associated with other stars may induce currents of particles with energies of the order of that of cosmic ray particles.

523.7 : 621.396.822 **76**

Radio Waves from the Sun.—G. C. Southworth. (*Nature, Lond.*, 1st Sept. 1945, Vol. 156, No. 3957, pp. 273–274.) Review of 3252 of 1945 in relation to the work of Jansky (948 of 1938 and earlier work) and Reber (336 of 1943 and earlier work, and 1028 of 1945).

523.755 : 551.51.053.5 **77**

Problems of the Solar Corona.—M. Waldmeier. (*Naturwissenschaften*, Feb./Mar. 1944, Vol. 32, Nos. 5/13, pp. 51–57.) Includes an account of the origin in the corona of the intense ultra-violet radiation that probably causes the ionosphere.

523.78 : 621.396.11 **78**

" Mass Attack " on Secrets of Radio Waves.—(*See* 165.)

537.591 **79**

What are Cosmic Rays? [Book Review].—P. Auger. Univ. of Chicago Press, 1945, 128 pp., $2.00. (*Sci. Mon., N.Y.*, Aug. 1945, Vol. 61, No. 2, p. 158.) " . . . very short and very well written," but necessarily incomplete.

LOCATION AND AIDS TO NAVIGATION

621.396.11 : 538.566.2 **80**

Experimental Investigation of the Structure of an Electromagnetic Field over the Inhomogeneous Earth's Surface.—Alpert & Gorozhankin. (*See* 161.)

621.396.6 : 629.13. **81**

The Marconi General Purpose Aircraft Wireless Equipment.—Scott. (*See* 238.)

621.396.677 **82**

The Design of Directional Aerial Arrays.—Cooper & Green. (*See* 36.)

621.396.9 **83**

Radar Warfare.—D.G.F. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 92–97.) A general descriptive article illustrated by twelve photographs. It includes the CH early warning stations and plotting centres, GCI and AI (ground control of interception and airborne interception), PPI (plan position indicator) with examples of " shadow pictures", and some account of the radar gun-control systems.

621.396.9 **84**

Radar in the United States Army.—R. B. Colton. (*Proc. Inst. Radio Engrs., N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 740–752.) " The evolution of radar technique is traced and the radar-development program of the United States Army Signal Corps at the Signal Corps Laboratories, Fort Monmouth, New Jersey, described from its inception to America's entry in the War. Two radars developed by the Signal Corps Laboratories during this period, SCR-268 and SCR-270, are described in detail."

Original tests on SCR-268 showed the range to be 40 000 yd with an average distance error of 700 yd, an azimuthal error of 4°, and an elevational error of 2½°. The final design operated at a frequency of 205 Mc/s with a pulse rate of 4 100 per sec. The duration of the pulse was 5 μs, and the peak power 50 kW.

SCR-270, designed for long-range warning, had a power of 100 kW at a carrier frequency of 110 Mc/s. The pulse rate was 625 per sec and the duration 15 to 40 μs. The array rotated 5 revs per min. The range was 120 miles for bombers and 75 miles for fighters. The distance error was 2 miles and the direction error 4°. A plan-position indicator was introduced. See also 87.

621.396.9 **85**

Fundamentals of Radar—2. —(*Wireless World*, Nov. 1945, Vol. 51, No. 11, pp. 326–329.) The Air Interception (AI) system working on 1½ metres and at centimetre wavelengths is described, the former using fixed aerials with broad polar diagrams, the latter using a narrow beam, scanning spirally. The theoretical relations between transmitted power, range and wavelength are discussed. For part 1 see 3903 of 1945.

621.396.9 **86**

Radar in War and in Peace.—R. Watson-Watt. (*Nature, Lond.*, 15th Sept. 1945, Vol. 156, No. 3959, pp. 319–324.) An historical review of the war-time and pre-war development of radar, and a discussion of peace-time applications.

621.396.9 **87**

The SCR-268 Radar.—D. G. F. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 100–109.) The transmitting and receiving arrays are mounted on a pedestal and are manually controlled. The transmitting array consists of 16 crossed-dipoles and 16 reflectors with an open transmission line; the azimuth receiving array consists of a " bill board " 6 dipoles wide and 4 dipoles high with reflectors; the elevation array consists of a similar " bill board " 2 dipoles wide and 6 dipoles high. The transmitting beam is 10° wide between the 3 db points; the azimuth and elevation arrays have a directivity of 12° and 9° respectively, and lobe switching is provided, giving an accuracy of ± 1°. The range accuracy is ±200 yards. The keying unit includes a 4 098 c/s electron-coupled Hartley oscillator using a 6SJ7 valve. By means of sharpening, flattening, and over-driven amplifier circuits, short pulses are produced which are successively amplified by a 6F6 stage, two 6L6 valves in parallel, and a 304 TL triode. A peak pulse of 3 500 volts is thereby applied to the modulator unit, which includes eight 304 TL valves in parallel. The transmitter includes sixteen 100TS valves in a ring circuit. The essential features are pulse repetition frequency 4 098 per sec, pulse width 6 μs, peak power 75 kW, radio frequency 205 Mc/s, receiver power sensitivity 10^{-13} W, maximum range 22 miles, total weight 37 tons, total power required 15 kVA. A-scope presentation is utilised with " split image " display. See also 84.

621.396.9 **88**

Radar and the Bell System.—(*Bell Lab. Rec.*, Sept. 1945, Vol. 23, No. 9, pp. 325–328.) A short account of radar applications in various theatres of war with special reference to the part played by the Bell System Laboratories.

621.396.9 : 623.454.25 **89**

Proximity Fuse.—(*Wireless World*, Nov. 1945, Vol. 51, No. 11, p. 331.) A complete transmitter and receiver with aerial, batteries and fuse-operating mechanism, is built into the nose of an anti-aircraft shell. The transmitter sends out a cone of c.w. radiation which is reflected by the target and arrives back at the receiver at a different frequency due to relative motion of the shell and target (Doppler effect). The beat note formed is amplified and used to trigger the fuse.

MATERIALS AND SUBSIDIARY TECHNIQUES

538.221 : 621.317.41.029.5 **90**

Permeability of Iron at Radio Frequencies.—A. W. Smith, F. P. Dickey & S. W. Foor. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 268..280.) Summary of 1603 of 1945.

594.514.1 : 537.228.1 : 621.39 **91**

Piezo Electric Quartz Crystals.—J. L. Creighton. (*P.O. elect. Engrs' J.*, Oct. 1945, Vol. 38, Part 3, pp. 65–69.) The relationship between the atomic grouping and the piezo-electric effect. Methods of applying piezo-electric crystals to telecommunications. Methods of minimizing the variation with temperature of crystal oscillators.

594.514.1 : 537.531 : 621.396.611.21 **92**

X-rays Alter Wavelength, Change Color of Gems.—(*See* 126.)

620.193.7 **93**

Cathodic Protection.—L. H. Woodman. (*Sci. Amer.*, July 1945, Vol. 173, No. 1, pp. 44–46.) Corrosion of underground metallic structures by the action of galvanic currents may be prevented by connecting to them large masses of magnesium. These have a higher potential than the structure, which becomes a cathode and is not corroded.

620.193.7(213) : 621.315.5 : 621.315.6 **94**

Electrolytic Corrosion—Methods of Evaluating Insulating Materials used in Tropical Service.—Thompson & Mathes. (*See* 256.)

621-752 : 621.38/.39 **95**

Vibration Control for Electronic Products.—F.H. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 134–139.) A review of the many types of specialised units designed to provide isolation from vibration and shock. Many types of rubber mountings are described and illustrated, and the degree of vibration absorption in each case is stated.

621-752 : 678 **96**

Vibration Insulation and Structural Rubber.—J. A. Connon. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, June 1945, Vol. 64, No. 6, pp. 324–328.) A compilation of information on the fundamentals of mechanical vibrations and the properties of structural rubber, related especially to the protection of delicate equipments.

621.3.032.53 **97**

Glass-to-Metal Seal Design.—W. J. Scott. (*Electronic Engng*, Nov. 1945, Vol. 17, No. 213, pp. 764–767.) Factors which need consideration are wetting, stress, expansion, elasticity, plasticity, and shaping to avoid local stress concentrations. Excerpt from a comprehensive paper to appear in *J. sci. Instrum.*

621.315.616 : 546.287 **98**

The Application of Silicone Resins to Insulation for Electric Machinery.—J. DeKiep, L. R. Hill & G. L. Moses. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, Mar. 1945, Vol. 64, No. 3, pp. 94–98.)

Tests on silicone resins, silicone treated materials, and wire-wound apparatus treated with silicone varnish show a considerable improvement in the thermal endurance of the insulation. While further tests are required, it is suggested that this class of insulation should be differentiated from class B and C insulation, with appropriate temperature limits, so that designers may make use of its advantages. For discussion see *Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, June Supplement 1945, Vol. 64, pp. 460–462.

621.315.616 : 546.287 **99**

Organo-Silicon Compounds for Insulating Electric Machines.—T. A. Kauppi & G. L. Moses. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, Mar. 1945, Vol. 64, No. 3, pp. 90–93.) The physical and chemical properties of the silicone compounds are described. The use of these resins in place of the organic resins used as bonds, impregnants and surface treatments, gives a great improvement in the thermal stability of the insulation, the most important single factor in insulation life. For discussion see *Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, June Supplement 1945, Vol. 64, pp. 457–458.

621.315.616 : 679.5 **100**

Notes on Plastics.—J. Taylor. (*Electrician*, 16th Nov. 1945, Vol. 135, No. 3520, pp. 541–542.) The dielectric constant and power factor at high frequencies of polystyrene are both low. Its mechanical properties do not change much with temperature up to 70° C; a chlorinated compound, polydichlorstyrene, is stable up to 112° C. Polystyrene is light, water-resistant, and unaffected by weak acids, strong alkalis and many organic solvents. It has a high refractive index and good light transmission properties so is used for special lenses in light condensers and signal lamps. Styrene can be made to co-polymerise with other polymers, such as butadiene, to produce synthetic rubbers for use as wire and cable coverings.

621.315.617.3 **101**

Control of Electrical-Insulating Varnishes.—D. L. Gibson & C. H. Braithwaite. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, July 1945, Vol. 64, No. 7, pp. 520–524.) Varnishes used in the manufacture of radio equipment do not have reproducible properties unless frequent checks are made of chemical and physical properties. A suitable routine involves daily measurements of viscosity and density, and periodic chemical examination, with adequate filtration of the varnish.

621.317.35 **102**

Graphical Analysis of Complex Waves.—L. S. Cole. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 142–145.) A simple account of the Fourier analysis of a complex wave-form, giving the detail and formulae for 6-, 8-, and 12-point schedules.

621.318.22 **103**

Industry's Permanent Pull.—(*Sci. Amer.*, July 1945, Vol. 173, No. 1, pp. 36 . . 49.) Properties and uses of some modern materials used for permanent magnets.

621.385.832 **104**

Characteristics of Luminescent Materials for Cathode Ray Tubes.—(*J. Televis. Soc.*, June 1945, Vol. 4, No. 6, pp. 143–144.) Summary of a discussion by the Radio Section I.E.E., led by C. G. A. Hill.

621.386.1 : 620.179] (091) **105**

The Growth of Industrial Radiology.—L. Mullins. (*Electronic Engng*, Nov. 1945, Vol. 17, No. 213, pp. 760–763.) Within a year of the discovery of X-rays their use for industrial purposes had commenced. Advances in photographic film, and in the design of tubes have helped the subsequent growth of radiology, which was greatly accelerated during the two world wars.

MATHEMATICS

51 **106**

An Extension of the Limits of Applicability of the Small Parameter Method [for solving non-linear oscillation problems].—S. M. Rytov. (*C.R. Acad. Sci. U.R.S.S.*, 30th April 1945, Vol. 47, No. 3, pp. 181–184.)

517.512.2 : 621.317.35 **107**

Note on the Fourier Series for Several Pulse Forms.—Lattin. (*See* 116.)

531.2 **108**

The Stress Distribution in a Long Circular Cylinder when a Discontinuous Pressure is applied to the Curved Surface.—C. J. Tranter & J. W. Craggs. (*Phil. Mag.*, April 1945, Vol. 36, No. 255, pp. 241–250.)

534.131 **109**

The Oscillations of an Isotropic Elastic Sphere.—G. I. Petrashen. (*C.R. Acad. Sci. U.R.S.S.*, 30th April 1945, Vol. 47, No. 3, pp. 172–176.)

621.392.5/.6 **110**

The Application of the Characteristic Equation of a Matrix to the Evaluation of the Range of Frequencies for which Currents are passed through Networks with Four or More Terminals without Attenuation.—H. V. Lowry. (*Phil. Mag.*, April 1945, Vol. 36, No. 255, pp. 255–264.)

621.396.615.17 **111**

Theory of Synchronization of Relaxation Auto-Oscillatory Systems.—K. Theodorchik. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 2, pp. 139–143.) The general theory is worked out by König's iteration method and conditions of stable synchronisation are found by plotting some of the functions as in Lamerey's method. It is shown that the Nth order synchronisation bands can never overlap.

51 : 621.39 **112**

Applied Mathematics for Radio and Communication Engineers [Book Review].—C. E. Smith. McGraw-Hill, N.Y., 231 pp., $3.50. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 422..426.) A "refresher course for home study . . ."

518.2 **113**

Sechsstellige Trigonometrische Tafel [Book Review].—H. Brandenburg. Lorentz, Leipzig, reproduced by Edwards, Michigan, 304 pp., $5.00. (*Phil. Mag.*, Apr. 1945, Vol. 36, No. 255, p. 296.) With a list of errata by L. J. Comrie.

MEASUREMENTS AND TEST GEAR

621.317.33 : 621.315.212.1 **114**

Coaxial Cable Tests.—P. H. Ware. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 130–134.) An elementary description of the measurement of cable characteristics at relatively low radio frequencies by the open and shorted method, using series or parallel substitution in closed resonant circuits and observing the change of reading of a variable air capacitor and the change in the width of the resonance curve; or by similar substitution in a radio-frequency bridge. The relevant formulae and some typical examples are included.

621.317.35 **115**

Graphical Analysis of Complex Waves.—Cole. (*See* 102.)

621.317.35 : 517.512.2. **116**

Note on the Fourier Series for Several Pulse Forms.—W. J. Lattin. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 783–784.) " Fourier-series expressions for symmetrical rectangular, triangular, and trapezoidal pulses are derived in a form from which general curves of the magnitudes of the harmonic-amplitude coefficients may be plotted. From these curves it is possible to obtain the values of the amplitude coefficients of the harmonics for any ratio of pulse duration t to cycle period T."

621.317.353 **117**

A Simple Method of Measuring Distortion in A.F. Oscillators and Amplifiers.—L. W. Smith. (*R.S.G.B. Bull.*, Nov. 1945, Vol. 21, No. 5, pp. 71–72.) The output of the amplifier is connected through a potentiometer to a bridge circuit which can be adjusted to balance out the fundamental frequency, using a high-gain amplifier with a visual indicator in the output as a detector. With the fundamental present, the same reading in the detector is obtained by adjusting the potentiometer; the two potentiometer readings give the ratio of the harmonics to the full wave.

621.317.382 **118**

Power Measurements at Very High Frequencies.—W. Maron. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 216–217.) Measurement in the range 20–40 W at 100 Mc/s by means of a 60 W 110 V lamp (resistance about 70 ohms), the brightness of which is measured by a photocell. The lamp is calibrated by low-frequency a.c..

621.317.41.029.5 : 538.221 **119**

Permeability of Iron at Radio Frequencies.—A. W. Smith, F. P. Dickey & S. W. Foor. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 268..280.) —Summary of 1603 of 1945.

621.317.7 **120**

Industrial Test Equipment Design.—T. Powell. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 135–137). A paper based on notes made during the training and supervision of a crew of repair-force men in a large ship-yard, where test gear was roughly handled. It details vulnerable features and emphasises the need for better dust and water proofing.

621.317.726 : 621.3.015.33 **121**

Transient Peak Voltmeter.—C. Ryerson & M. Aronson. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 110–111.) The amplitude of a single short pulse is determined by amplifying the transient voltage, then charging a capacitor through a diode, the holding-on action of which permits the charge to be maintained long enough for measurement by means of a balanced-bridge d.c. voltmeter equipped with a 0–200μA indicating instrument. The device has four ranges, 1, 5, 10 and 20 V full scale, and is a.c.-mains operated.

621.317.73 **122**

Reactor Measurements.—H. L. Daniels. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 146–148.) Describes a complete source and valve-voltmeter network for the measurement of the characteristics of air- or iron-cored inductors so that these characteristics are not affected by the rest of the circuit. The valve source, from which a.c. and d.c. can be derived simultaneously is arranged, by the use of current feed-back, to have an exceedingly high output impedance (2.5–90 megohms, depending on the selected current range, 0.3–50 mA) and the valve voltmeter is buffered by a cathode-follower circuit. Details of the method of measurement are given.

621.317.73.083.4.085.3 **123**

Bridge Null-Indicator.—E. W. Herold. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 128–129.) A sensitive tuned null indicator for a 1 000 c/s bridge, providing discrimination against harmonics, off-balance phase indication, visual balance indication, and over-load protection derived from delayed automatic gain-control. An input of 10 μV is sufficient to give an observable deflection on either the meter or the cathode-ray indicators.

621.317.738 : 621.385.032.2 **124**

Production Tester for Small Values of Capacitance.—L. Y. Hanopol. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 160..180.) The instrument consists of a constant-voltage source, a measuring network, and a high-impedance detector. A frequency of 465 kc/s is used, and the detector consists of a high-gain, three-stage, band-pass amplifier. An accuracy of 3 per cent. is claimed over the range 0.005 to 200 $\mu\mu$F. A two-page article.

621.319.4 : 621.317.372 **125**

Determining Q of Capacitors.—Pepperberg. (*See* 49.)

621.396.611.21 : 537.531 : 594.514.1 **126**

X-rays Alter Wavelength, Change Color of Gems. —(*Elect. Engng., N.Y.*, July 1945, Vol. 64, No. 7, p. 250.) A short note mentioning, *inter alia*, the use of X-ray irradiation for rapidly adjusting the frequency of a quartz crystal to a desired value.

621.396.615.12 **127**

Design of Stable Heterodyne Oscillators.—Moore. (*See* 241.)

621.396.615.17 : 621.317.755] .089.6 **128**

Time-Base Calibration.—W. W. Ludman. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 117–119.) Time-displacement linearity of oscilloscope sweep is measured at tenth-microsecond intervals by the use of a crystal-controlled multivibrator chain. The circuit described provides a sweep-triggering pulse and a constant-amplitude continuous calibrating signal.

621.396.619 : 621.396.615.17 **129**

Square-Wave [pulse] **Modulator for Signal Generator.**—W. R. Piggott. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 260..268.) Summary of 1536 of 1945.

621.396.67 : 621.317.384.029.56/.58 **130**

A Proposed Standard Dummy Antenna for Testing Aircraft-Radio Transmitters.—Stewart. (*See* 243.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

351.811 : 621.38 **131**

Automatic Control of Vehicular Traffic.—(*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 150..154.) Brief description of an automatic vehicle controller developed by the Northern Electric Co., Montreal. The detector, which is buried in the ground at each approach to an intersection, comprises two magnetised parallel steel bars with coil assemblies mounted so that passage of a vehicle induces a small voltage. The voltage is amplified and operates relays which control the dispatching system of lights.

535.336.2.05 : 621.389 **132**

Electronics of the Mass Spectrometer.—J. A. Hipple, D. J. Grove & W. M. Hickam. (*Elect. Engng, N.Y.*, April 1945, Vol. 64, No. 4, pp. 141–145.) Deals with the technique of making an automatic self-recording mass-spectrograph. A motor-driven potentiometer varies the magnetic field, and the ion current is measured by a Speedomax recorder energised through a d.c. amplifier. Automatic provision is made for increasing scanning speed when the ion current drops below a predetermined level. Two automatic devices are incorporated which enable recording to be carried out over a wide range of ion currents. A " mass-marker " calibration circuit is provided.

61 : 621.396.6 **133**

Medical Probe.—R. E. Ricketts. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 300..312.) A preliminary description of a portable u.s.w. transreceiver which can be used to indicate irregularities of bone and organs under the skin, and the size and placement of large organs, by utilising the effect of differences in the permittivities of tissue.

620.179.14 : 621.38 **134**

Crack Detector for Production Testing.—J. H. Jupe. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 114–115.) Description of a compact electronic instrument designed by Salford Electrical Instruments Ltd. The specimen is in the magnetic field of an oscillator. The induced eddy currents affect the frequency to an extent dependent on the presence of surface cracks. The instrument can indicate cracks from 0.000 5 to 0.25 inch deep.

621 : 621.395.625 **135**

It Pays to Listen [Detection of faults in machinery by change in characteristic noise]. (*See* 18.)

621.3.083.7 **136**

A Modulated-Frequency System of Telemetering.—H. E. Renfro & A. P. Peterson. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, Feb. 1945, Vol. 64, No. 2, pp. 45–47.) Two variable capacitors, having a common rotor fixed to the spindle of the primary instrument, are incorporated in the transmitter, and so arranged that the capacitance of one increases as the capacitance of the other decreases. The plates are shaped so that the edge exposure, and therefore the electrostatic torque on the rotor due to edge effect, is dependent only on the potential difference between the rotor and the stators, and is independent of the angular position of the rotor. With the same potential difference applied across each capacitor the torque is neutralised and the calibration of the primary instrument is therefore not invalidated by electrostatic torque on the rotor. The capacitors vary the frequency of two temperature-compensated oscillator circuits, between 50–49.5 kc/s, and 60–60.5 kc/s, respectively. The difference frequency is fed through a low-pass filter to an amplifier that is transformer coupled to the line to the receiver at the control station. The receiver consists of a high-frequency amplifier, a local oscillator of fixed frequency 9.9 kc/s, that gives a difference frequency of 100–1 100 c/s with the incoming signal. This is passed through a low-pass filter to an amplifier feeding a frequency meter incorporating the final indicating instrument. Six complete sets of this system have been in continuous operation for several years.

621.3.083.7 : 654.942 **137**

Electronics Aids Waterway Development.—E. H. Woodman. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 120–128.) A description of devices used by the U.S. War Dept. Engineering Corps. For the measurement of wave heights in breakwater and harbour studies, a vertical set of contacts is arranged so that the water short-circuits some of them. The contacts are connected to a resistance potentiometer and the current produced when constant potential difference is applied depends on the number immersed. For hydrostatic pressure measurement a cell has been developed with a diaphragm which, on flexing, changes the reactance of an iron-cored inductance, and for strain measurement, resistance-wire strain gauges are used. Associated electronic equipment is described. Some of the devices have been used for recording the deflection of road and pavement surfaces.

621.314.3 : 578.088.7 **138**

Biological Amplifiers.—Parnum. (*See* 45.)

621.314.3 : 578.088.7 : 621.396.822 **139**

Biological Amplifiers.—Parnum. (*See* 44.)

621.315.1/.5 : 621.317.3.082.78 **140**

Wire Splice Detector.—F. S. Hird. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 98–99.) Steel wire under test is magnetised longitudinally by passing it through a strong magnetic field. It is subsequently passed through a detector coil in which voltages are generated by the motion of the magnetic poles produced at the discontinuities. The sensitivity is such that a single-strand splice in a 14-strand cable can be detected.

621.316.313 **141**

Dual A-C Network Calculator.—Parker. (*See* 47.)

621.317.787.2 : 621.316.5.064.2 **142**

An Interval Timer for [switching-] **Arc Duration.**—J. S. Quill. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, May 1945, Vol. 64, No. 5, pp. 237–240.) Voltage appearing across the opening contacts under test starts the timing, and current disappearing from the circuit finishes it. During the interval a capacitor charges linearly, the final voltage across it gives a measure of the arc time.

621.318.572 **143**

Electronic Counting.—Weber. (*See* 50.)

621.362 : 621.3.036.64 **144**

Electronic Control of Furnace Temperatures.—(*Elect. Engng, N.Y.*, Aug. 1945, Vol. 64, No. 8, p. 289.) See 4124 of 1945.

621.365.5 + 621.365.9 + 621.369 **145**

The Place of Radiant, Dielectric and Eddy-Current Heating in the Process Heating Field.—L. J. C. Connell, O. W. Humphreys and J. L. Rycroft. (*J. Instn elect. Engrs*, Part II, Oct. 1945, Vol. 92, No. 29, pp. 385–399. Discussion, pp. 399–402.) The paper outlines the various methods of heating available and points out the particular features of each. General formulae are given for heating and temperature distribution where possible. Tables indicate methods technically suitable and preferable for heating insulators or conductors under various conditions of rate of rise of temperature and heat penetration. Methods involving heat transfer from an external source include contact heating, natural and forced convective heating, and radiant heating using lamps or exposed resistors.

Several industrial applications are treated in detail. These include the setting of adhesives, drying of surface finishes, treatment of plastics, drying, and surface hardening of metals. Long bibliography.

621.365.5 + 621.365.92 **146**

High-Frequency Heating of Conductors and Non-Conductors.—R. M. Baker & C. J. Madsen. (*Elect. Engng, N.Y.*, Feb. 1945, Vol. 64, No. 2, pp. 50–57.) The simple theory of induction and dielectric heating is given, with its applications to various industrial processes, such as brazing, soldering, curing, case-hardening and heat-treating. Induction heating is inherently non-uniform, dielectric heating, provided the material is homogeneous, gives almost perfect uniformity in heating throughout. High-frequency heating is usually more expensive than more conventional methods, both in cost of equipment and in running costs, but it is more adaptable; it increases the speed of the process, advantageous when rapid heating is required, as in surface hardening and in continuous processes, and it is clean and compact. It can be used on materials such as iron, steel, brass, copper, wood, plastics, paper, nylon and other synthetics, rubber, and food. Electronic sources of high-frequency heat are more costly than rotating machine generators, but electronic sources permit the use of higher frequencies, an advantage in many applications, although, for a given size of material, there is an upper limit to the frequency because stationary wave patterns may be formed with consequent non-uniformity of heating.

621.365.52 **147**

Induction Heating of Moving Magnetic Strip.—R. M. Baker. (*Trans. [mon.] Amer. Inst. elect. Engrs*, April 1945, Vol. 64, No. 4, pp. 184–189.) Derivation of equations for power-factor efficiency and density of heating under all conditions. General curves illustrate the limitations of strip thickness, frequency, and density of heating. Factors controlling the choice of frequency are discussed: "At strip speeds of 1 000 feet per minute and a temperature rise of 250°C, strips thicker than 0.04 cm can be heated satisfactorily at 9 600 c/s."

621.365.52 **148**

Design of Induction-Heating Coils for Cylindrical Nonmagnetic Loads.—J. T. Vaughan & J. W. Williamson. (*Trans. [mon.] Amer. Inst, elect. Engrs*, Aug. 1945, Vol. 64, No. 8, pp. 587–592.) "Equations are presented for the calculation of the required number of coil turns to match a given power source for [single layer] solenoidal coils with coaxial cylindrical loads of non-magnetic materials in electromagnetic induction circuits. The equations apply to both solid and hollow loads. A correction factor is established for coil shortness providing the coil length is equal to or greater than the coil diameter. Also given are equations for power distribution and impedance values. The accuracy of the calculations is substantiated by experimental results."

621.365.92 **149**

A Survey of Dielectric Heating.—M. J. Maiers. (*Elect. Engng*, June 1945, Vol. 64, No. 6, pp. 210–211.)—Developments in the use of alternating electric fields (3–30 Mc/s) for heating non-conducting materials. The destruction of weevils in grain, the manufacture of plywood and other fabricated wooden articles, the dehydration of hygroscopic materials, and the cooking of food. The greatest advantage over other methods of heating is the development of heat throughout the body of the substance instead of at its surface only.

621.365.92 **150**

The Role of Frequency in Industrial Dielectric Heating.—G. W. Scott, Jr. (*Trans. [mon.] Amer. Inst. elect. Engrs*, Aug. 1945, Vol. 64, No. 8, pp. 558–562.) None of the variables in the heating equation is completely independent of frequency. As the frequency is increased the overall heating efficiency is reduced by the effect of stray capacitance the useful load capacitance decreases and the useful length of material which can be dealt with is reduced because of troubles due to standing waves. Increasing the frequency may reduce the duration of the heating cycle, but increased production rate may not be economical unless accompanied by increased volume of production. For large-scale industrial heating involving load capacitances up to $500\mu\mu$F, and output powers as high as 100 kW, the frequency band 10–30 Mc/s will prove most useful.

621.365.92 : 679.5 **151**

Better Plastics Heating.—(*Sci. Amer.*, July 1945, Vol. 173, No. 1, pp. 22–24.) An account of high-frequency heating.

621.38 **152**

Electronics—An Industry Comes of Age.—D. D. Knowles. (*Elect. Engng, N.Y.*, Mar. 1945, Vol. 64, No. 3, pp. 106–108.) Radio, and the use in all aircraft and on all ships of detection devices developed during the war, will probably remain for some time the greatest field for the application of electronics, but others are being developed rapidly. Induction and dielectric heating increase the speed and efficiency of many processes. The use of power transmission lines to carry information saves money and material. Electrical power can be converted into any form, and switched quickly and accurately. Other applications are in specialised instruments such as the electron microscope and the mass spectrometer.

621.38 : 6 **153**
Electronic Applications in [U.S.] **Industry.**—Sommer. (*See* 213).

621.396.9 : 623.454.25 **154**
Proximity Fuse.—(*See* 89.)

629.13 : 621.38 **155**
Aviation's Electronic Requirements.—D. W. Rentzel. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. f288..300.) The requirements, for which performance desiderata are detailed, include an obstacle indicator, radio altimeter, automatic position reporter, and a means of sending written communications to aircraft.

629.13 : 621.38 **156**
Fingertip Control for Formation Flying.—D. G. Taylor & G. Volkenant. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 98–101.) Description of a pistol-grip control, which, by means of two mutually perpendicular potential dividers, introduces signals into the auto-pilot bridge circuits, thus enabling the advantages of the auto-pilot controls to be combined with effortless manual control in formation flying.

629.13 : 621.38 **157**
Flying Electronics.—V. Zeluff. (*Sci. Amer.*, June 1945, Vol. 172, No. 6, pp. 348–350.) Many electronic devices are now available for improving the safety and consistency of aviation. In commercial and private aviation these will be used for navigation, communication, accurate indication of fuel supply, warning of ice formation, landing, and collision warning.

629.13 : 621.38 **158**
Control in the Air.—(*Sci. Amer.*, July 1945, Vol. 173, No. 1, pp. 26–28.) Methods of operating flying controls, and of controlling the engine and other features of an aircraft by the use of electronic devices.

669 : 621.38 **159**
Metals by Electronics.—V. Zeluff. (*Sci. Amer.*, April 1945, Vol. 172, No. 4, pp. 210–212.) Many processes in the production of metals have been speeded up and improved by the use of electronic devices. Photoelectric cells have been used to control tipping at the mines, to regulate shearing and other processes in the mills and to detect holes in sheet metal. Photoelectric pyrometers control high temperature processes, and mercury arc rectifiers supply d.c. power to large industrial plants.

PROPAGATION OF WAVES

538.566 : 621.396.11 **160**
Diffraction of Radio Waves by Surface of Earth.—V. A. Fock. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 2, p. 150.) Summary of a paper before the Acad. Sci., U.S.S.R. A theoretical investigation assuming a homogeneous earth surface, taking account of diffraction, but neglecting ionosphere. An approximation to the exact value of the vertical field component is obtained as a function of the height of the source, the distance of the receiver, the radius and dielectric property of the earth. Well-known formulae can be obtained by reduction of the expression given. Methods are given for the numerical evaluation of the series and integrals used.

538.566.2 : 621.396.11 **161**
Experimental Investigation of the Structure of an Electromagnetic Field over the Inhomogeneous Earth's Surface.—J. Alpert & B. Gorozhankin. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 2, pp. 115–122.) The phase structure of the field over a stretch of sea near a hilly coast is investigated by a radio interferometer and a direction finder. The results are plotted as contours of equal phase velocity and show variations of as much as 0.5% in some directions at distances up to 5λ from the radiator. At distances of the order of 8λ, for all directions, the phase velocity approximates to *c*. The direction-finding errors are of different sign according to the angle of the shore line, whereas most workers have indicated that the sign of the coastal error must always be negative.

621.316.99 **162**
Grounding Principles and Practice, I.—Fundamental Considerations on Ground Currents.—Rüdenberg. (*See* 29.)

621.392 **163**
The Plane-Wave Resolution of Guided Waves.—Mackeown & Miles. (*See* 30.)

621.396.029.63/.64 **164**
Microwave Techniques.—Jenks. (*See* 185.)

621.396.11 : 523.78 **165**
"Mass Attack" on Secrets of Radio Waves.—(*Proc. Instn Radio Engrs, Aust.*, Aug. 1945, Vol. 6, No. 2, pp. 9–10.) The effects of the recent solar eclipse on the ionisation of the atmosphere were studied by observing the variation of received signal strength of long, medium and short wave transmissions over paths that passed through, or close to, the track of totality, by vertical incidence measurements of the heights of the ionised layers, by direction-finding measurements, and by radar.

RECEPTION

621.314.3 + 621.383 + 621.396.62 **166**
The State of Development and Physical Limit [of sensitivity] **of Communication Devices, Radiation Converters and Radiation Storage Devices.**—O. Schäfer. (*Naturwissenschaften*, Feb./Mar. 1944, Vol. 32, Nos. 5/13, pp. 62–68.) A comparison of the physical and practical limits of sensitivity of a number of devices for converting energy from one form to another.

The limiting sensitivity of the dark-adapted retina can be such as to enable detection of about one quantum per second per light-sensitive element. This corresponds to perception of a point light source giving a power flux at the pupil of about 10^{-16} W/cm^2, though some writers give a smaller figure. The ear can detect a continuous note at 2 000 c/s with a power flux of 10^{-16} W/cm^2. This limit is about 10 db worse than the physical limit due to thermal agitation of the air molecules against the eardrum.

The sensitivity of the condenser microphone is theoretically such as to enable the detection of impact of individual air molecules, but the practical limit of the sensitivity of microphones is set by the noise in the amplifiers with which they are associated. To overcome resistance noise alone in an amplifier, a microphone needs to deliver $4kT\Delta f$, corresponding to 10^{-16} W with $\Delta f = 10^4$ c/s, a sensitivity about the same as that of the unaided ear. Reduction of Δf to 1 c/s changes this figure to 10^{-20} W, but then the sound must last for at least one second because of the build-up time of the sharply-tuned resonator, and the mean frequency must not vary by more than $\frac{1}{2}$ c/s. This is an example of the increase of sensitivity by the use of an energy-storage device. Shot effect and other sources of receiver noise reduce the sensitivity further.

The limit of sensitivity of radio receivers depends on the noise in the amplifiers, and on cosmic and atmospheric noise. The aerial, considered alone, reaches its natural limit, as cosmic and atmospheric noise are easily detectable. In the wavelength ranges where these noises are small, telegraph signals containing about 10^{-19} Joule can be detected. At λ 10m this corresponds to a field with power flux about 10^{-23}W/cm², which is far smaller than the flux detectable by any other instrument or unaided sense organ. This performance is due to the aerial's property of collecting energy from an area of the wave-front equal to about $0.03\lambda^2$.

A modern alkali vacuum photocell yields about one electron per 100 incident light quanta, so that 10^3 quanta/sec is detectable assuming an adjustment time of 10 sec. With a cell requiring an exposure of 1 sec, the detectable energy flux is about 10^{-14} W/cm², *i.e.*, 100 times more than is needed for the eye. In low-pressure gas-filled cells in which multiplication of the current is produced by ionisation, the sensitivity is increased to about equal to that of the eye (10^{-16} W/cm²). The light-counter can detect about 10 quanta/sec with an adjustment time of 10^{-2} sec. In storage cameras such as the iconoscope increased exposure would greatly increase sensitivity, but a limit is set by amplifier noise and by imperfection of the device itself. A television equipment is about 10^3 less sensitive than the eye. An image converter (*Bildwandler*), in which an image at an invisible wavelength (*e.g.*, infra-red) is converted to a visible image, requires 10^{11} quanta/sec per sensitive element.

A sensitised photographic emulsion has a physical limit of about one absorbed quantum per grain, but the spontaneous reduction on development of a number of the unexposed grains causes a practical limit worse by 10^2 or 10^3. For a panchromatic emulsion exposed for 1 sec through a lens corresponding to that of the eye, 10^3 times more light is needed to produce a detectable image than is needed to stimulate the eye.

621.396.029.63/.64 **167**

Microwave Techniques.—Jenks. (*See* 185.)

621.396.3 : 621.396.812.3 **168**

High-Speed Radio-Telegraphy.—Robinson : Roddam. (*See* 188.)

621.396.611.21 : 621.396.621.54 : 621.396.619.081.41 **169**

Crystal Tuned F.M. Receivers.—W. Maron. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 138–141.) The full realisation of f.m. possibilities requires a very high degree of local oscillator stability (±0.01%). The article states the case for quartz-crystal control of the local oscillator, using separate crystals for each station to be received. It gives a detailed description of an experimental receiver built to receive any of eight f.m. stations in the band 42–50 Mc/s. The crystals were of about 5 Mc/s fundamental frequency, and the fifth harmonic was used for control. Stations were selected by an 8-position switch.

621.396.611.21 : 621.396.621.54.029.6 **170**

Crystal Oscillators in F.M. and Television [receivers].—S. X. Shore. (*Communications*, Sept. 1945, Vol. 25, No. 9, pp. 54..88.) A description of some crystal plate cuts and their application in v.h.f. receivers is given and illustrated with circuit diagrams. In general, crystals are best suited to fixed-frequency working and so could be easily incorporated in press-button tuning systems. Variable-frequency crystals allowing of tuning over several hundred kc/s can be made, but are expensive and have a lower stability with temperature. Crystals can be cut so as to be easily excited to vibrate in harmonic modes. The AT cut is easier to excite than the BT cut, but with both, the frequency is limited to about 50 Mc/s by the shunt capacitance of the crystal. Continuation of 3826 of 1945.

621.396.615.12 **171**

Design of Stable Heterodyne Oscillators.—Moore. (*See* 241.)

621.396.619.018.41 : 621.396.82 **172**

Interference in F.M. Receivers.—R. N. Johnson. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 129–131.) Calculations on interference assuming an idealised frequency-modulation receiver are shown to be valid when applied to a representative commercial receiver. The type of interference considered is that which results from two signals having the same average frequency, one being considered as the desired signal, and the other as the interfering signal.

621.396.62 **173**

Radio Receiver Specifications including a Method of Specifying Performance.—A. S. McNicol. (*R.S.G.B. Bull.*, Nov. 1945, Vol. 21, No. 5, pp. 66–68.) Receiver specifications should be simplified so that the relative merit of any two receivers can be easily ascertained. A "Communications Index" could be used, based on a figure for each characteristic of the receiver, such as selectivity, sensitivity, noise equivalent, image ratio and tuning drift. Suggestions for determining these figures are given.

621.396.62 : 623.6 **174**

Army Set R107.—E. Forster. (*Wireless World*, Nov. 1945, Vol. 51, No. 11, pp. 343–344.) Comments on 3286 of 1945 by the designer of the set. On c.w. a signal of 1 μV will be heard 20 db above noise level at 3 kc/s bandwidth, and 0.4 μV for the same signal/noise ratio when the a.f. note filter is in use.

621.396.621.53 **175**

Long-Wave Converter.—H. B. Dent. (*Wireless World*, Nov. 1945, Vol. 51, No. 11, pp. 341–342.) A circuit diagram of a converter using a single triode-hexode valve, suitable for reception at 1 500 m when the receiver is tuned to 500 m.

621.396.822 **176**

Receiver Sensitivities and Noise at the Input Stage.—M. Morgan. (*Marconi Rev.*, Jan. 1945, Vol. 8, No. 76, pp. 24–31.) The noise has three components, due to the r.f. valve itself, the matching device between valve and aerial, and the aerial. It is most convenient to consider all noise sources in terms of their equivalent thermal-noise resistance because then for several sources simple addition of equivalent resistances enables the net noise to be determined. Simple equations are given for computing the value of each noise component, and typical examples for particular valves are given. Expressions are also derived for receiver sensitivity in terms of " detune " ratios.

621.396.822 : 523.7 **177**

Radio Waves from the Sun.—Southworth. (*See* 76.)

621.397.62 **178**

Separating Sound from Vision in Television Reception.—Sturley. (*See* 233.)

STATIONS AND COMMUNICATION SYSTEMS

621.314.65 : 621.396.71 **179**

High-Voltage Steel-Tank Mercury-Arc Rectifier Equipments for Radio Transmitters.—Read. (*See* 205).

621.314.65 : 621.396.71 **180**

The Application of High-Voltage Steel-Tank Mercury-Arc Rectifiers in Broadcast Transmitters—Bevan. (*See* 206).

621.39 **181**

Electrical Communication.—J. Mills. (*Sci. Mon., N.Y.*, Aug. 1945, Vol. 61, No. 2, pp. 138–142.) A general descriptive account of processes entailed in electrical communication systems, generation, modulation, amplification, transmission, selection, and demodulation, and some of the problems associated therewith.

621.39 : 623.6 **182**

[U.S.] **Army Ground Communication Equipment.**—R. B. Colton. (*Elect. Engng, N.Y.*, May 1945, Vol. 64, No. 5, pp. 173–179). Army equipment may be divided into fixed type and combat type. In base areas line telephony is primary, construction becoming lighter and more temporary as the combat area is approached. In the combat area radio communication is often the only possibility. Communication systems are organised in conformity with the military command, *e.g.* battalion communications. Various types of equipment are described.

621.391.1 **183**

Multichannel Communication Systems: Preliminary Investigation of Systems based upon Modulated Pulses.—F. F. Roberts & J. C. Simmonds. (*Wireless Engr*, Nov. 1945, Vol. 22, No. 266, pp. 538–549.) A discussion of the principles underlying communication systems involving pulse technique, using either a line or radio transmission link. Pulses of energy from each channel in turn are transmitted along the link, the pulse repetition frequency of each channel being at least twice that of the highest frequency contained in the signals. The pulse chains may be generated either mechanically or electronically, synchronisation being effected by a regular increase in amplitude, or reversal of polarity of one of the pulses. Several methods of modulation are available:—

(*a*) Amplitude—using double grid or triode valves.

(*b*) Pulse width—using a saturated triode: this has the advantage that non-linear distortion does not affect operation.

(*c*) Delay—this involves varying the time-relationship of the pulses in the given channel, using a phase-shifting circuit, or otherwise.

A mathematical analysis of each is given, together with a discussion of the required transmitter stability. Demodulation is accomplished by means of low-pass filters, charge and discharge of capacitors, or by using double-grid tubes. The usefulness of the radio link is restricted due to cross-talk between channels, but with a line link this can be reduced to tolerable proportions.

The first of two articles.

621.395.44 **184**

The Unit Bay 1B Coaxial Cable Transmission System.—R. A. Brockbank & C. F. Floyd. (*P.O. elect. Engrs' J.*, Oct. 1945, Vol. 38, Part 3, pp. 82–87.) Continuation of 3660 of 1945 describing the more important panels of the Unit Bay.

621.396.029.63/.64 **185**

Microwave Techniques.—F. A. Jenks. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 120–127.) A survey of propagation features and of terminal equipment design. Radiation and range formulae are given and illustrated, for non-directive and directive systems. It is shown, for example, that with parabolic reflectors, a tenth of a watt at 10 cm wavelength could give a range of over 4 000 miles. There is a brief description of the application of crystal control to transmitters and of automatic frequency control, by reference to a stabilised source or to a resonant cavity, for transmission and reception.

621.396.24 **186**

Microwave Communications Chain may replace Present Radio Beam System for Aircraft.—(*Telegr. Teleph. Age*, Oct. 1945, Vol. 63, No. 10, pp. 9..35.) Enthusiastic support for the proposed (U.S.) nation-wide Raytheon microwave relay system to work in seven broad bands between 1 900 and 2 600 Mc/s. Stations would be built on mountain tops to cover up to 500 miles, and facilities for television, f.m. *etc.*, provided. See also 3378 of 1945.

621.396.24 : 621.397.26 **187**

V.H.F. Multiple-Relay Television Network.—F. J. Bingley. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 102–108.) Description of a six-station chain through which video programmes originating in Washington are broadcast in the Philadelphia area, on frequencies in the 210–236 Mc/s band. Relay stations are on four hill-top sites giving 100ft clearance over all intervening terrain. The receiving and transmitting antennae are located near to each other but in positions of zero coupling, and operate on different carrier frequencies. In each relay station a synchronising expander unit is used to counteract the compression of the synchronising signal by the non-linear characteristic of the relay transmitters in the synchronising region.

621.396.3 : 621.396.812.3 **188**

High-Speed Radio-Telegraphy.—J. Robinson : T. Roddam. (*Wireless World*, Nov. 1945, Vol. 51, No. 11, p. 343.) Correspondence on the Romac system, following 3676 of 1945, on the intelligibility of the signals in conditions of fading.

621.396.44 : 621.315.052.63 **189**

Power-Line Carrier Channels.—M. J. Brown. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, May 1945, Vol. 64, No. 5, pp. 246–250.) The use of a power cable for carrier-frequency communication requires the consideration of factors not involved if the cable is designed for power alone. The characteristic impedance must be known for satisfactory design of the coupling to it of the communications equipment. The attenuation can be calculated from formulae giving the increase in resistance due to skin effect at the carrier frequency used, but measurement shows that losses may be up to five times the calculated value, particularly where stranded conductors are installed, so an empirical formula is given. Losses also occur in the couplings to the line, in the units necessary to by-pass apparatus (*e.g.* circuit-breakers) in the line, and in the traps isolating spur lines from the carrier-frequency current. With well designed equipment these losses should be small.

621.396.44 : 621.396.619 : 621.315.052.63 **190**

A Comparison of the Amplitude-Modulation, Frequency-Modulation, and Single-Side-Band Systems for Power-Line Carrier Transmission.—R. C. Cheek. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, May 1945, Vol. 64, No. 5, pp. 215–220.) The three systems are considered with reference to their ability to meet problems of attenuation, interfering noise, and required band-width. Frequency modulation only gives an improvement in signal/noise ratio at the expense of an increased band-width. With unity deviation the gain in signal/noise ratio obtained by using frequency modulation instead of amplitude modulation is 4.8 db with a 1.5 increase in band-width. The single-side-band system only requires half the band-width needed for amplitude modulation, and the gain in signal/noise ratio is 9 db when the same power is used. The communication system as a whole can be made more flexible when single-side-band is used. Amplitude-modulated systems can be readily converted to single-side-band by the addition of the necessary units. For discussion see *Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, June Supplement 1945, Vol. 64, pp. 450–452.

621.396.6 : 621.396.619.018.41 **191**

Airline V.H.F. F.M. Systems.—T. W. Hall. (*Communications*, Sept. 1945, Vol. 25, No. 9, pp. 39..91.) A description of the Trans-Canada communication system between the mainland and Vancouver Island (48 miles). The transmitting frequencies are 95.5 and 73.5 Mc/s, the deviation ±15 kc/s, and the transmitter power 50 W.

621.396.66 **192**

Automatic Fader.—Hunter. (*See* 65.)

621.396.712 **193**

Canada's International Short-Wave Plant.—H. M. Smith. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 112–116.) The new C.B.C. installation at Sackville, New Brunswick. This site was selected to be outside the magnetically-disturbed zone. Three antenna systems have been installed beamed on Europe, South America and Australia and, by reversal, on Central America and New Zealand, Eastern Asia, and South Africa. Each system comprises several arrays for 6, 9, 11, 15, and 17 Mc/s, of the driven curtain type, with non-driven reflectors. Each curtain consists of two side-by-side vertical stacks of four horizontal elements. Two 50 kW transmitters are used, and the service started in 1944.

621.396.712 : 621.396.61 **194**

2UE Broadcasting Station.—Stevenson. (*See* 240.)

621.396.8 **195**

Slow-Speed Relaying.—W. Stockman. (*Wireless World*, June 1945, Vol. 51, No. 6, p. 175.) A proposal for reducing noise interference with communications. Record the signal, *e.g.* on steel tape, transmit from the recording at about one-fifth the natural speed, record again at the receiving station, and afterwards reproduce this recording at the natural speed. By this process modulation frequencies would be reduced during transmission, so that narrower-band equipment could be used, with consequent reduction in noise level and in the effect of selective fading.

621.396.97 + 621.397 **196**

Developments in Radio and Television.—Baker. (*See* 222.)

621.396.97 : 356.251.11 **197**

Britain's Monitoring [of enemy broadcasts] **Service.** (*Wireless World*, July 1945, Vol. 51, No. 7, pp. 211–212.)

SUBSIDIARY APPARATUS

537.531 : 62 **198**

Discussion on " A Survey of X-rays in Engineering and Industry."—V. E. Pullin. (*J. Instn elect. Engrs*, Part I, Oct. 1945, Vol. 92, No. 58, pp. 390–395.) Discussion of 3431 of 1945.

537.531(091) **199**

The Discovery of X-rays.—J. A. Crowther. (*Electronic Engng*, Nov. 1945, Vol. 17, No. 213, pp. 755–758.)

621.526 : 621.391 **200**

The Servo Problem as a Transmission Problem.—E. B. Ferrell. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 763 – 767.) The analogy between the action of a servo and an amplifier is drawn. Many mechanical problems can be dealt with using electrical circuit analysis as described by Nyquist (1932 abstracts p. 279) and Bode (4231 of 1940).

621.314.2 **201**

High-Quality Communication and Power Transformers.—E. B. Harrison. (*J. Soc. Mot. Pict. Engrs*, Sept. 1944, Vol. 43, No. 3, pp. 155–167.) Low external fields are obtained from power transformers using astatically-balanced solenoids and narrow cores. The laminations have air gaps staggered in adjacent pairs to increase permeability. The large coil surface exposed allows twice the heat to be dissipated for half the usual chassis space with 3% drop in efficiency. Power chokes have air gaps between astatic coils, for low leakage. Harmonics are eliminated by arranging clamps and bolts so that little magnetic flux passes through them. Audio chokes following this design have Qs of 70 at 1 000 c/s.

The design is given of push-pull audio transformers for wide frequency range, with excellent balance and light weight. The output transformer uses many turns to keep flux density low, and a long magnetic path to obtain correct inductance. The high-impedance primary is sectionalised to reduce distributed capacity, the leakage reactance being reduced by surrounding the core with a copper eddy-current shield. Astatic coils reduce hum pick-up 30 db. A method of vacuum impregnation is described. A screened input transformer is described attenuating external fields 90 db.

621.314.2 : 536.2 **202**

Formulas for Calculating Temperature Distribution in Transformer Cores and Other Electric Apparatus of Rectangular Cross Section.—T. J. Higgins. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, April 1945, Vol. 64, No. 4, pp. 190–194.) Formulae are derived for the temperature distribution, the maximum temperature, and the average temperature in transformer cores and other electrical apparatus of rectangular cross section and of such general shape that the temperature distribution is essentially two dimensional. The theory is applied to a numerical example and checks well with experimental data. For discussion see *Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, June Supplement 1945, vol. 64, pp. 493–494.

621.314.2.08 **203**

Note on the Measurement of Transformer Turns-Ratio.—P. M. Honnell. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 808–809.) "This note shows that in many important cases the turns-ratio of iron-core transformers is given by the simple relation $N_1/N_2 = \sqrt{X_{sc1}/X_{sc2}}$, in which X_{sc1} and X_{sc2} are the reactive components of the short-circuit primary and secondary impedance of the windings concerned."

621.314.3 : 623.6 **204**

Some Fundamental Considerations in Military Amplifier Design.—S. L. Chertok. (*J. Soc. Mot. Pict. Engrs*, July 1944, Vol. 43, No. 1, pp. 10–18.) Outlines the requirements for shock-proof equipment operating under extreme conditions of temperature and humidity. Indicates the arrangement and design of components and the treatment of materials. Resistance to salt-spray and splash-proofing tests are described. Electrolytic capacitors and resistors are major problems. Components are mounted on terminal boards for easy servicing.

621.314.65 : 621.396.71 **205**

High-Voltage Steel-Tank Mercury-Arc Rectifier Equipments for Radio Transmitters.—J. C. Read. (*J. Instn elect. Engrs*, Part II, Oct. 1945, Vol. 92, No. 29, pp. 453–468. Discussion, pp. 490–494.) A detailed account of the design and development of equipments supplying 30–700 kW at 10–20 kV d.c. In all the cases dealt with arc suppression by grid control is used. The effect of the circuit on some of the factors affecting backfire at high voltages is briefly discussed. For application see 206.

621.314.65 : 621.396.71 **206**

The Application of High-Voltage Steel-Tank Mercury-Arc Rectifiers to Broadcast Transmitters.—P. A. T. Bevan. (*J. Instn elect. Engrs*, Part II, Oct. 1945, Vol. 92, No. 29, pp. 469–489. Discussion, pp. 490–494.) Review of B.B.C. practice, including a description of a recent type of pumpless air-cooled equipment. Analytical and design data for various types of rectifier connection used in practice, smoothing circuits, and grid-control features.

621.315.3 (23.03) **207**

Simulated-High-Altitude Testing of Aircraft Ignition Cables and Connectors.—H. H. Race & A. M. Ross, Jr. (*Trans.* [*mon.*] *Amer. Inst. elect. Engrs*, Jan. 1945, Vol. 64, No. 1, pp. 20–25.) Ignition systems requiring from 9–12.7 kV peak must have an arc-over voltage in excess of this for efficient operation of the sparking plugs. Other sources of failure are corona cutting of the cable insulation, water-vapour condensation, and thermal deterioration of the cable insulation. An electronic interrupter to simulate the magneto has been used to investigate the behaviour of various types of cable and connector assemblies when subjected to cycles of low pressure and high temperature. It was found that neoprene-sheathed cable was considerably better than lacquered-braid cable, and that sealing of the connector by a grommet was essential.

621.315.62 : 519.283 **208**

Statistical Methods applied to Insulator Development and Manufacture.—Taylor. (*See* 255.)

621.316.578.1 : 621.385.832 **209**

Controlling Activation Schedules at Exhaust.—M. Silverman. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 180..192.) A timer used for obtaining uniformity in the production of cathode-ray tubes.

621.317.7 **210**

Industrial Test Equipment Design.—Powell. (*See* 120.)

621.317.755 **211**

Midget CRO for Maintenance Technicians.—(*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 202..206.) Can operate from mains or 12V battery, with 15W consumption. 1½ inch diameter screen, brilliance and focusing controls, provision for intensity modulation. Plate sensitivity 4V/mm. Linear time base 20 c/s to 25 kc/s, with internal or external synchronisation. Single-stage amplifier with maximum gain 400 from 50 c/s to 10 kc/s.

621.319.42 (213) **212**

Glass-Sealed Capacitors.—V. J. Simson. (*Electronic Engng*, Nov. 1945, Vol. 17, No. 213, p. 780.) Normal types of tubular capacitor fail under tropical conditions or on long sea voyages; the glass-sealed type do not. The copper end cap requires special design to ensure that it yields slightly before breaking stresses are reached in the glass. Brief account of tests and results.

621.38 : 6 **213**

Electronic Applications in [U.S.] **Industry.**—W. Sommer. (*Electronic Engng*, Nov. 1945, Vol. 17, No. 213, pp. 777–779.) Nineteen thousand questionnaires were sent to subscribers to fourteen selected technical journals. An average of 21 electronic devices are used by each of the 796 firms that replied. The replies are analysed.

621.383.5 **214**

The Electromotive Force of the Selenium Barrier-Layer Photo-Cell.—R. A. Houstoun & A. F. Howatson. (*Phil. Mag.*, April 1945, Vol. 36, No. 255, pp. 279–287.) A selenium barrier-layer photo-cell may be regarded as having a constant e.m.f. which sends a current through a resistance inversely proportional to the intensity of illumination. (See 3641 of 1942 and back references.) This e.m.f. has been more accurately determined, and its variation with colour investigated. The e.m.f. usually increased from blue to red, contrary to the authors' expectations, and the effect is not explained. The effect of an applied (polarising) e.m.f. was investigated, and gave increased resistivity. The combined effect of light and polarising voltage is represented by an empirical formula with a theoretical basis over a limited range. The gain in sensitivity from the polarising voltage does not justify the extra trouble in operation.

621.386 **215**

A Modern X-ray Tube Factory.—A. G. Long. (*Electronic Engng*, Nov. 1945, Vol. 17, No. 213, pp. 772–774.) Materials must conform closely to specification, metals, for example, being spectrographically examined before acceptance as usable. High precision is required in electrode assembly. Special ventilation is provided in the glassworking section. Almost surgical cleanliness is maintained throughout, and handling reduced to a minimum during construction.

621.394.625.11 **216**

Construction of a Morse Recorder.—C. B. Pretty. (*R.S.G.B. Bull.*, Nov. 1945, Vol. 21, No. 5, pp. 72, 76.)

621.395.625.3.015.3 **217**

Frequency-Modulated Magnetic-Tape Transient Recorder.—H. B. Shaper. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 753–760.) The transient is recorded on a loop of steel tape driven by a synchronous motor so that the tape makes one revolution every 0.1 sec. A carrier frequency of 10 kc/s is continuously recorded on the tape and then removed on passing the obliterating head. When a signal arrives it modulates the carrier, but also fires a thyratron that quenches the obliterator. 0.1 sec later a second thyratron quenches the carrier, leaving a completed record which is then picked up, amplified and demodulated, and then applied to an oscilloscope with a 10 c/s time-base to give a steady image on the screen. The recorder has a frequency range of 0.02 to 1 000 c/s with some response at 2 000 c/s.

621.315.5 + 621.318.4] (021) **218**

Electric Coils and Conductors [Book Review].—H. B. Dwight. McGraw-Hill, N.Y., 351 pp., $5.00. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 418..422.) Comprehensive reference work on the design of inductors, transformers and conductors.

TELEVISION AND PHOTOTELEGRAPHY

621.314.3 + 621.383 + 621.396.62 **219**

The State of Development and Physical Limit [of sensitivity] **of Communication Devices, Radiation Converters and Radiation Storage Devices.**— Schäfer (*See* 166.)

621.383.5 **220**

The Electromotive Force of the Selenium Barrier-Layer Photo-Cell.—Houstoun & Howatson. (*See* 214.)

621.396.24 : 621.397.26 **221**

V.H.F. Multiple-Relay Television Network.—Bingley. (*See* 187.)

621.397 + 621.396.97 **222**

Developments in Radio and Television.—W. R. G. Baker. (*Elect. Engng, N.Y.*, April 1945, Vol. 64, No. 4, pp. 152–155.) The problems to be faced in providing sound and television broadcast facilities throughout the United States are discussed in relation to recent technical advances. Reference is made to the potentialities of f.m. broadcasting for providing small communities with a satisfactory service. Stress is laid on the importance of " capture effect " in reducing the width of the frequency band necessary to give such a service.

621.397 **223**

Television Broadcasting Practice in America—1927 to 1944.—D. G. Fink. (*J. Televis. Soc.*, March 1945, Vol. 4, No. 5, pp. 112–118.) Long summary of 3955 of 1945.

621.397 : 654.17 **224**

The Television Committee's Report.—(*J. Televis. Soc.*, March 1945, Vol. 4, No. 5, pp. 98–99.) Summary of and extracts from the Hankey report. See also 3002 of 1945.

621.397 : 654.17 **225**

" Television Committee's Report."—R. W. Hallows. (*Wireless World*, July 1945, Vol. 51, No. 7, pp. 207–208.) A reply to 3001 of 1945 and 228 of January criticising 2254 of 1945.

621.397.26 **226**

Scrambled Television.—(*J. Televis. Soc.*, June 1945, Vol. 4, No. 6, pp. 135, 142.) The summary of a patent which makes it possible for a television programme to be picked up by subscribers only. Regularly spaced frame synchronising signals are used for the frame scan, but irregularly spaced ones for the line scan, both at the transmitter and the receiver. Only the former are transmitted, the latter being supplied at the receiver.

621.397.3 **227**

Remarks on Colour Television.—(*J. Televis. Soc.*, Mar. 1945, Vol. 4, No. 5, p. 123.) Summary of Dr. P. C. Goldmark's evidence before the F.C.C.

621.397.5 **228**

Television "Fallacies".—C. W. Sheffield. (*Wireless World*, June 1945, Vol. 51, No. 6, p. 181.) Letter criticising 2254 of 1945.

621.397.5 **229**

Studio Technique in Television.—D. C. Birkinshaw & D. R. Campbell. (*J. Televis. Soc.*, June 1945, Vol. 4, No. 6, pp. 136–142.) Abridged version of 3961 of 1945.

621.397.5 **230**

A New Television System.—Pye, Ltd. (*Electrician*, 16th Nov. 1945, Vol. 135, No. 3520, p. 540.) Sound and television are broadcast on the same frequency by transmitting the sound during the vision " fly-back " time when no vision signals are transmitted. With the present television definition

10 125 sound pulses are transmitted per second. This system reduces the cost of the transmitter and the receiver, the possibility of interference between sound and vision in the receiver is eliminated, automatic volume control can be used to ensure a steady picture, and colour television and stereophonic sound should be easier to achieve. See also *Nature, Lond.*, 10th Nov. 1945, Vol. 156, No. 3967, p. 565.

621.397.62 **231**

The Television Receiver Sound Channel.—(*J. Televis. Soc.*, March 1945, Vol. 4, No. 5, p. 122.) Summary of discussion at meeting of Radio Section I.E.E. on 19th Dec. 1944.

621.397.62 **232**

Better Television.—(*Sci. Amer.*, June 1945, Vol. 172, No. 6, pp. 362–363.) Improvements in projection, incorporating plastic mirrors and lenses, have made possible the reproduction, at reasonable cost, of pictures which are brighter, clearer and larger than those available on pre-war sets. Other improvements are a high-voltage cathode ray tube and circuits to discriminate against noise.

621.397.62 **233**

Separating Sound from Vision in Television Reception.—K. R. Sturley. (*J. Televis. Soc.*, March 1945, Vol. 4, No. 5, pp. 100–111.) A description of the problems, and "an examination . . . of the design of the i.f. stages of a superheterodyne receiver for accepting one of several vestigial sideband television transmissions, which may be adjacent one to the other". Also, "a survey, illustrated by numerical examples, of the methods of preventing interference with the vision programme from its associated, and an adjacent, sound signal. The absorber type of filter, also used as a pick-up circuit for the associated sound programme, is treated in detail, as is the parallel resonant circuit-capacitance voltage divider, the series resonant and series-parallel resonant shunt filter. Reference is made to the possibilities of a resonant coupling in the i.f. transformer, and of cathode feedback."

621.397.62 **234**

Restorer-Circuit Operation.—Last. (*See* 67.)

654.17 **235**

The Social Function of Television.—W. H. Cazaly. (*J. Televis. Soc.*, June 1945, Vol. 4, No. 6, pp. 130–134.) Two important aspects of television are simultaneity of perception with occurrence, and the consequent psychological influence. The former can be exploited with advantage by industry, but also by unscrupulous politicians, and the latter provides satisfaction to the herd instinct by allowing wider participation in events. Television can play a big part in the drift towards co-prosperity if correctly controlled, but if not it can become "a greater curse than any that has inflicted mankind".

TRANSMISSION

621.395.44 **236**

Wide-Band Program-Transmission Circuits.—E. W. Baker. (*Elect. Engng, N.Y.*, Mar. 1945, Vol. 64, No. 3, pp. 99–103.) To utilise the high-fidelity characteristics of frequency modulation, wide-frequency-band circuits are necessary between studio and transmitter, and between network stations. The existing programme networks usually have 5 kc/s band widths, but networks with band widths of 15 kc/s or more can be supplied if required.

621.396.029.63/.64 **237**

Microwave Techniques.—Jenks. (*See* 185.)

621.396.6 : 629.13 **238**

The Marconi General Purpose Aircraft Wireless Equipment.—J. L. Scott. (*Marconi Rev.*, Jan./Mar. 1945, Vol. 8, No. 76, pp. 1–11.) The T1154/R1155 equipment is designed to provide transmission by c.w., m.c.w. and r.t. over the frequency ranges 0.2 to 0.5 and 3 to 10 Mc/s, reception over the ranges 0.075 to 0.5, 0.6 to 1.5, and 3 to 18.5 Mc/s, and direction finding over the ranges 0.6 to 1.5, and 3 to 18.5 Mc/s.

The transmitter weighing 45 lb comprises a master oscillator driving a power amplifier giving an output of 80 W on c.w. and 35 W on m.c.w. or r.t. The receiver weighing 26 lb gives an output of 50 mW with an input of about 10 μV, uses an intermediate frequency of 560 kc/s, and has a band width of 5 kc/s. The d.f. equipment includes a visual indicator consisting of a twin-needle instrument; intersection of the needles is controlled by rotation of the loop, the bearing on the loop scale being observed when the needle intersection occurs on the scale centre. Homing is carried out by locking the loop athwartships, permitting the pilot to direct the course so as to bring the needle intersection to the scale centre.

621.396.61 **239**

Stepping Up Transmitter Power from 500 W to 1 kW.—L. A. Reilly. (*Communications*, Sept. 1945, Vol. 25, No. 9, pp. 42..90.) How the power of the WSPR transmitter was increased from 500 W to 1 kW without interrupting the service. An entirely new 1 750 V power supply was needed and a complete circuit diagram of this and of the whole transmitter is given.

621.396.61 : 621.396.712 **240**

2UE Broadcasting Station.—M. H. Stevenson. (*Proc. Instn Radio Engrs, Aust.*, July 1945, Vol. 6, No. 1, pp. 3–11.) Detailed description of a 1 000 W a.m. transmitter in Sydney, N.S.W. Wavelength not stated. The aerial is a self-supporting quarter-wave radiator with a ground system of 120 radial wires each half a wavelength long.

621.396.615.12 **241**

Design of Stable Heterodyne Oscillators.—J. B. Moore. (*Electronics*, Oct. 1945, Vol. 18, No. 10, pp. 116–118.) A compensation for temperature effects to better than 10 parts in a million per degree centigrade is claimed, by balancing the negative coefficient of the inductor against a positive coefficient given by a specially-designed variable capacitor, having rotor plates of copper-plated invar and a stator with plates and separators of different metals, and ceramic end plates. Residual changes due to stray and fixed capacitances are balanced by small compensating solid-dielectric capacitors. The stabilisation is apparently relative to fairly slow drifts of ambient temperature. The oscillator has a 2 to 1 tuning range about 24 Mc/s.

621.396.615.17 **242**

Theory of Synchronization of Relaxation Auto-Oscillatory Systems.—Theodorchik. (*See* 111.)

621.396.67 : 621.317.384.029.56/.58 **243**

A Proposed Standard Dummy Antenna for Testing Aircraft-Radio Transmitters.—C. Stewart, Jr. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 772–777.) The antenna consists of 35ft of coiled coaxial cable with copper cooling fins between turns, and terminating with an r.f. milliammeter or diode. Characteristics simulate those of aircraft antennae for the range 2–30 Mc/s. Maximum power dissipation 125 W.

VALVES AND THERMIONICS

537.583 : 621.3.032.216 **244**

Pulse Emission Characteristics of Oxide Cathodes.—R. L. Sproull. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 270..278.) Summary of 2642 of 1945.

621.385 + 621.386](091) **245**

Electronics and Development of Electronic Tubes.—I. E. Mouromtseff. (*J. Franklin Inst.*, Sept. 1945, Vol. 240, No. 3, pp. 171–192.) An historical survey of the development of various types of electron tubes from the earliest discharge tube, and their applications to industry. Electron Beam Tubes: the Lenard, Roentgen and cathode ray tubes were developed directly from Crookes' discharge tube. Mercury Vapour Tubes: includes a detailed description of a modern mercury arc rectifier (ignitron) and its method of working. High Frequency Tubes: development of high-power tubes for radio and industrial applications. Ultra High Frequency Tubes: description of typical u.h.f. tubes (Types 880 and 530) and applications of dielectric heating to industry. Super High Frequency Tubes: brief description of the development of the magnetron and velocity-modulated tubes, and their possible future applications. An extensive historical bibliography is given.

621.385 **246**

Valve Colour Code?—K. E. Marcus. (*Wireless World*, June 1945, Vol. 51, No. 6, pp. 181–182.) Proposed use of six colours to indicate heater voltage and current.

621.385 **247**

Recent Electron-Tube Developments.—S. B. Ingram. (*Elect. Engng, N.Y.*, Jan. 1945, Vol. 64, No. 1, pp. 22–24.) Special valves developed for carrier-system long-distance telephones, which require valves with high transconductance, low input and output capacitance, and long life with low filament consumption; and for radio-telephone systems where small transit time, duplicate anode and grid leads, and short electrode leads are needed. Thyratrons, with a mixture of mercury vapour and a rare gas, are used in regulated rectifiers for battery chargers. Cold-cathode gas-filled valves, giving many years of trouble-free service, find many applications in telephone systems.

621.385 **248**

Postwar Electron Tube Business.—W. C. White. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 92–97.) It is estimated that about ten million pounds worth of tubes of all types were manufactured annually between 1935 and 1939, and that for the immediate post-war period the annual demand is likely to be about twenty million pounds worth.

621.385.012.8 **249**

"Valve Vectors."—D. H. Parnum: K. R. Sturley. (*Wireless World*, July 1945, Vol. 51, No. 7, pp. 209–210.) Parnum criticises 2179 of 1945, and Sturley replies.

621.385.832 **250**

Characteristics of Luminescent Materials for Cathode Ray Tubes.—(*J. Televis. Soc.*, June 1945, Vol. 4, No. 6, pp. 143–144.) Summary of a discussion by the Radio Section I.E.E., led by C. G. A. Hill.

621.385.832 : 621.316.578.1 **251**

Controlling Activation Schedules at Exhaust.—M. Silverman. (*Electronics*, Sept. 1945, Vol. 18, No. 9, pp. 180..192.) A timer used for obtaining uniformity in the production of cathode-ray tubes.

621.38 **252**

Theory and Applications of Electron Tubes [Book Review].—H. J. Reich. McGraw-Hill, N.Y. & London, 2nd edn. 1944, pp. 716, $5. (*Elect. Engng, N.Y.*, May 1945, Vol. 64, No. 5, p. 205.)

621.38 **253**

An Introduction to Electronics [Book Review].—R. G. Hudson. Macmillan, N.Y., 1945, 97 pp., $3.00. (*Sci. Mon., N.Y.*, Aug. 1945, Vol. 61, No. 2, p. 158.) ". . . for the lay reader."

MISCELLANEOUS

001.891 : 6 **254**

Research—Creator of Employment.—A. W. Hull. (*Elect. Engng, N.Y.*, Jan. 1945, Vol. 64, No. 1, pp. 25–27.) Properly directed research, by developing new products and more efficient processes, promotes progress, combats unemployment, and raises the general standard of living.

519.283 : 621.315.62 **255**

Statistical Methods Applied to Insulator Development and Manufacture.—J. J. Taylor. (*Trans. [mon.] Amer. Inst. elect. Engrs*, July 1945, Vol. 64, No. 7, pp. 495–498.) Quality control in high-voltage insulator manufacture, and the use of associated scientific data for estimation and prediction purposes.

620.193.7(213) : 621.315.5 : 621.315.6 **256**

Electrolytic Corrosion—Methods of Evaluating Insulating Materials used in Tropical Service.—B. H. Thompson & K. N. Mathes. (*Trans. [mon.] Amer. Inst. elect. Engrs*, June 1945, Vol. 64, No. 6, pp. 295–299.) Laboratory tests are made with 100% relative humidity and dew at 35°C. The insulating material in sheet form is rolled round glass rods, and two coils one inch apart, each of three turns of copper wire, are wound on to it, 120 volts d.c. are applied between the coils for periods of up to 7 days, and corrosion is detected by periodic visual examination. Alternatively the current between the electrodes is measured. Typical results for a number of materials are given. An appendix deals with the factors influencing electrolytic corrosion. For discussion see *Trans. [mon.] Amer. Inst. elect. Engrs*, June Supplement 1945, Vol. 64, pp. 443–444.

ABSTRACTS AND REFERENCES

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In order to enhance the usefulness of the abstracts, certain changes have been made in their presentation. The subject sections have been increased in number and made more in accordance with the modern trend of development, and they are now arranged in alphabetical order. Universal Decimal Classification numbers have been added to each abstract, and heavy-face type has been adopted for the serial number and title in order to increase their legibility.

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ACOUSTICS AND AUDIO-FREQUENCIES

534.213.4 **257**

Attenuation of Sound in Circular Ducts.—E. Fisher. (*J. acous. Soc. Amer.*, Oct. 1945, Vol. 17, No. 2, pp. 121–122.) A method alternative to that of Molloy and Honigman (2677 of 1945) for calculating the attenuation constants. Good agreement between the results of the two methods is noted.

534.321.9 : 621.396.9 **258**

Acoustic Control in the Flight of Bats.—H. Hartridge. (*Nature, Lond.*, 27th Oct. 1945, Vol. 156, No. 3965, pp. 490–494.) Experiments show that bats, while flying, emit a discontinuous supersonic note that enables them to detect obstacles by observing the echo. The sensitivity of hearing is depressed during the emission of the supersonic pulse, and restored to receive the echo. There are close analogies with radar.

534.86 **259**

"Higher Fidelity" in Sound Transmission and Reproduction.—G. M. Nixon. (*J. acous. Soc. Amer.*, Oct. 1945, Vol. 17, No. 2, pp. 132–135.) A discussion of factors which include (*a*) lack of knowledge of absorbent properties of acoustic materials outside the range 128–4 096 c/s (*b*) absorption by the air at frequencies above 4 000 c/s (*c*) acute hearing loss for frequencies above 2 000 c/s with advancing age.

534.862 **260**

The Technique of Production [film] **Sound Recording.**—H. G. Tasker. (*J. Soc. Mot. Pict. Engrs*, Oct. 1942, Vol. 39, No. 4, pp. 213–227.) Mainly a description of the use and placement of directional microphones, and the effect of acoustical factors such as reflections.

621.394/.396].645.33 **261**

AC/DC Quality Amplifier.—(*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 354–357.) Output 2 W, negative feedback. Design and construction, including construction of output transformer.

621.394/.396].645.33 **262**

Improved Driver Stages for Class-B [a.f.] **Amplifiers.**—E. A. Henry. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 45–50, 118.) Use of the cathode-follower circuit for this purpose gives "practically perfect" regulation, large damping factor, low distortion, and wide frequency range. The relevant design principles are described, with typical examples.

621.394/.396].645.33 **263**

Parallel Tube High Fidelity Amplifier.—F. C. Jones. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 27–29.) Parallel-tube amplifiers may be designed to give a few watts output with less distortion than is produced by push-pull types having the same output. Design data are given for amplifiers using output stages of two paralleled beam power tetrodes with negative feedback.

621.395.623 **264**

A General Theory of Passive Linear Electroacoustic Transducers and the Electroacoustic Reciprocity Theorem. I.—L. L. Foldy & H. Primakoff. (*J. acous. Soc. Amer.*, Oct. 1945, Vol. 17, No. 2, pp. 109–120.) "A theory of the operation of passive linear electroacoustic transducers is developed on the basis of the most general linear equations (in this case, integral equations) relating the pressure and normal velocity at each point on the transducer surface and the voltage and current at the transducer's electrical terminals. These, together with the appropriate solutions of the wave equation expressed through the use of Green's functions for the medium in which the transducer is immersed and the equations defining the electrical termination of the transducer, completely characterize the behaviour of the transducer, and allow explicit calculation of such quantities as impedances, responses, etc., in terms of four parameters entering the fundamental equations.

"On the basis of this theory, a proof of the reciprocity theorem for electroacoustic transducers relating their speaker and microphone responses is presented embodying the conditions necessary for its validity. These conditions are essentially the existence of certain symmetry relationships among the transducer parameters. When these symmetry relationships may be expected to hold is to be discussed in Part II of this paper to appear later. Some applications of the theory are presented and others are outlined."

621.395.623 **265**

The Electroacoustic Four-Pole Transducer as an Acoustic Transmitter.—J. Müller-Strobel. (*Arch. Elektrotech.*, Jan./Feb. 1944, Vol. 38, Nos. 1/2, pp. 62–90.) The forces due to reaction of the sound field are introduced into the equations of motion of the diaphragm of a telephone receiver. Separation of the mechanical, electrical, and acoustic terms is consequently obtained, so that it is unnecessary to represent acoustic forces by effective added mass, stiffness, or damping. A damping proportional to diaphragm velocity is introduced as equivalent to the material and frictional damping proportional to displacement. This is permissible for small amplitudes.

Measurements were made on specially constructed earphones to find the relationship betweeen transducer impedance and acoustic reaction forces. The instruments were measured in a vacuum, with and without locking of the armature, giving the no-load impedance. The armature velocity and the phase-angle between the magnetic forces and the armature deflection are determined from the equations. The condition of resonance gave the polar moment of inertia of the cone-shaped diaphragm clamped at the edges.

The e.m.f. induced in the coil is determined, and the corresponding impedances calculated. Ohmic resistance, and eddy-current and hysteresis losses, experimentally determined, are represented by equivalent resistances. Measurements on transducers of two types showed the no-load running impedance to be partly dependent on current and partly independent of it. Current-dependence was only found near resonance, *i.e.*, for greatest mechanical deviation, and further investigation was confined to conditions giving impedances independent of current.

Figures are given for the stiffness of the diaphragm and for the torsional restoring couple on the armature. To determine the mechanical damping coefficients it is assumed that the change in exciting force with frequency has no effect on the form of the resonance curve. This is justified for small damping.

A survey of the behaviour of acoustic forces is obtained from measurements of impedance in a free sound field. A general expression is given for the relationship between the change in impedance and the acoustic force of the sound field causing it. This has a simple form in a free field, but was very complicated for the transducers used, as the cavities around the diaphragms, with their different resonant frequencies, substantially affected the sound field. The force can, however, be resolved into its component parts, so that the constructional features of the transducer can all be considered mathematically.

621.395.623.34 **266**

The Conical Sound Source.—P. G. Bordoni. (*J. acous. Soc. Amer.*, Oct. 1945, Vol. 17, No. 2, pp. 123–126.) The formula for the acoustic pressure due to a rigid cone axially vibrating in an infinite baffle, deduced by W. N. Brown (130 of 1942) is developed in the form of rapidly converging series. This enables directional and response curves to be plotted. It is found that "The pressure radiated by a mass-controlled cone decreases on the axis as frequency increases, instead of keeping constant, as it does with a disk. The directional curves are like those of a disk of the same radius, but a little flattened."

621.395.623.7/.8 **267**

The Quarter-Wave Method of Speaker Testing.—S. L. Reiches. (*J. Soc. Mot. Pict. Engrs*, May 1942, Vol. 38, No. 5, pp. 457–467.) A pulse roughly equivalent to a quarter of a sine wave, generated by discharging a condenser through a resistance, is used to excite the loudspeaker under test. The acoustic output is received by a microphone, and a reading of peak voltage is made.

621.395.623.7 **268**

The Moving Coil Loudspeaker.—G. R. Cooper. (*Overseas Engr*, Nov. 1945, Vol. 19, No. 218, pp. 45–48.) An elementary account of the causes of resonance. Improvements in response may be obtained by the use of baffles and also by introducing corrugations into the cone. It is hoped that the efficiency of loudspeakers will be increased by the use of new materials.

621.395.623.8 : 534.846.4 **269**

On the Acoustic Conditions and Preliminary Calculation for Setting Up Several Loudspeakers.—M. W. Matschinsky. (*Arch. Elektrotech.*, Jan./Feb. 1944, Vol. 38, Nos. 1/2, pp. 57–61.) Consideration of the physical and mathematical conditions for undistorted and good-quality hearing of speech and music. There must be no acoustically dead spots, and each sound reproduced by the system must be heard once only at any point in the area served. The following formulae are derived from the relationship between the field strength and time delay of a signal from a loudspeaker. For loudspeakers in the open, max $R = 1.5\ c\,\Delta t_{\text{rev.}}$, where R is the distance between two loudspeakers, c the velocity of sound in air, and $\Delta t_{\text{rev.}}$ the optimum reverberation time. In an enclosed space, max $R \doteqdot 1.5\ c\ (\Delta t_{\text{rev.}} - \Delta t_{\text{rev. tats}})$ where $\Delta t_{\text{rev. tats}}$ is the actual reverberation time of the space considered.

621.395.625.2 **270**

Business Recording Equipment.—R. Stone. (*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 32.. 106.) The requirements of an office recording-reproducing system are formulated and the Sound-Scriber equipment, using thin vinylite disks and the embossed-groove process, is described.

621.395.625.6 **271**

Some Practical Aspects of the Intermodulation Test [for sound films].—E. Meschter. (*J. Soc. Mot. Pict. Engrs*, Sept. 1945, Vol. 45, No. 3, pp. 161–170.) Effect of film density on intermodulation.

621.395.625.6 **272**

A Frequency-Modulated Control-Track for Movietone Prints.—J. G. Frayne & F. P. Herrnfeld. (*J. Soc. Mot. Pict. Engrs*, Feb. 1942, Vol. 38, No. 2, pp. 111–123, Discussion pp. 123–124.) "A 5-mil frequency-modulated track located between sound and picture areas is proposed to control reproduction in the theater from one or more soundtracks. A variation of approximately one octave in the control frequency provides a 30-db change in volume range which may be used in part for volume expansion of loud sounds or as noise reduction for weak sounds. The control-track frequency is varied manually and recorded simultaneously with the sound-track in the dubbing operation, the gain of the monitoring channel being varied in accordance with the control frequency to produce automatically the enhanced volume range desired from the release print."

621.395.625.6 **273**

Design and Use of Noise-Reduction Bias Systems [for sound-film equipment].—R. R. Scoville & W. L. Bell. (*J. Soc. Mot. Pict. Engrs*, Feb. 1942, Vol. 38, No. 2, pp. 125–147.) The improvement in film background-noise afforded by the biased recording method depends on the fact that noise is reduced when the average light transmitted through the film is held to the lowest usable value. This condition is obtained by partially closing the shutter of the light valve during quieter intervals, by means of a superimposed bias current; but this introduces undesirable noise components which, however, can be greatly reduced by the use of fine-grain sound films, and by pre-emphasis of the higher frequencies in recording, and subsequent attenuation in reproducing. Variable-area records have less noise than variable-density ones. Circuit diagrams suitable for bias recording are given together with photographs of a noise reduction unit.

621.395.665 **274**

Elimination of Relative Spectral Energy Distortion in Electronic Compressors.—B. F. Miller. (*J. Soc. Mot. Pict. Engrs*, Nov. 1942, Vol. 39, No. 5, pp. 317–323.) "The exaggeration of sibilant speech-sounds produced when electronic volume compression is employed in sound-recording channels is shown to be a form of amplitude-selective frequency distortion, which is generated by virtue of the normal mode of operation of the compressor. The practical elimination of this form of distortion is accomplished by equalization of the compressor control-rectifier input circuit, the amount of equalization employed being proportional to the inverse average relationship between rms speech-pressure per cycle and speech component frequency."

621.395.665.1 **275**

Volume Expansion.—J. G. White. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 24–25.) Summary of 3489 of 1945.

621.395.92 **276**

Tentative Code for Measurement of Performance of [air conduction] **Hearing Aids.**—Committee of the American Hearing Aid Association. (*J. acous. Soc. Amer.*, Oct. 1945, Vol. 17, No. 2, pp. 144–150.) "It is believed that these specifications represent the best of present practice, although additions may be made later to cover further material . . . [on which sufficient information is not yet available]."

621.396.615.11 **277**

Resistance-Capacity Oscillator.—F. G. Clifford. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 16..18.) Summary of 2989 of 1945.

621.396.62 **278**

A 21-Tube All-Purpose Receiver.—Marshall. (*See* 407.)

621.396.645.33 **279**

Audio Section Design Data for Battery Operated Receivers.—Sylvania Electric Products, Inc., Engineering Dept. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 36–37.) In battery-operated receivers it is desirable to secure uniform efficiency over a wide range of h.t. voltages. Optimum circuit values for a typical R-C coupled audio amplifier drive stage using a 1LD5 valve are given with graphs and a table showing performance over a range of operating conditions and circuit constants.

534.321.9 **280**

Der Ultraschall und seine Anwendung in Wissenschaft und Technik [Book Review].—L. Bergmann. VDI-Verlag, Berlin, 3rd edn. 1942, RM 25. (*Naturwissenschaften*, Feb./Mar. 1944, Vol. 32, Nos. 5/13, p. 91.) A comprehensive work.

AERIALS AND TRANSMISSION LINES

621.315.1 : 621.396.67 **281**

Power for Aerials.—F. C. McLean & F. D. Bolt. (*Elect. Rev., Lond.*, 7th Dec. 1945, Vol. 137, No. 3550, pp. 825–826.) Short report of a paper read to the Radio Section of the I.E.E., on the design and use by the B.B.C. of various types of open-wire power lines for feeding aerials at frequencies ranging from 0.2 to 25 Mc/s. "Attenuation must be minimized even at the cost of heavier transmission lines." The four-wire line is now in general use for powers above 50 kW.

621.315.2 **282**

Some New Features of Low-Voltage Cable.—Madsen & McKinley. (*See* 341.)

621.315.212.1 : 621.316.54 **283**

A Simple Coaxial Switch.—E. Burgess. (*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 58, 60.) The construction of a switch for connecting a common coaxial feeder to alternative aerials.

621.392 **284**

Waves and Wave Guides.—G. G. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 54–58.) A simple educational article. The complex wave-patterns in waveguides are described in terms of combinations of plane waves incident on and reflected from the surfaces of the guide.

621.396.67 **285**

Demonstrating the Properties of Aerials.—(*Electronic Engng*, Dec. 1945, Vol. 17, No. 214, pp. 800–805, 835.) An oscillator giving about 45 W output at 130 Mc/s is used to feed transmission lines and aerial systems. The current and voltage distributions are shown by detecting devices such as lamps or crystals used with deflecting instruments. 18 figures show numerous demonstrations.

621.396.67 **286**

RCA's Antennalyzer.—G. H. Brown. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 223, 226.)

The impedances of the elements of an aerial array are represented by adjustable interrelated circuits fed from the same r.f. source. The equivalent of directional response is represented on a c.r.t. indicator, so that the required amplitude and phase of feed currents can be deduced, thereby eliminating laborious and approximate theoretical solutions.

621.396.67 **287**

Technic of Antenna Gain Measurements.—G. Glinski. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 88..223.) An outline of basic equipment and arrangements required for v.h.f. work. The gain of a transmitting aerial is measured at the receiving point relative to a half-wave transmitting dipole fed with the same power. The insertion of a slotted section in the coaxial feeder permits the measurement of the standing wave in the line in order to obtain a measure of the power delivered to the aerial in the two cases. Graphical aids to computation are given.

621.396.67 : 621.317.33 **288**

Aerial Impedance Measurements.—L. Essen & M. H. Oliver. (*Wireless Engr*, Dec. 1945, Vol. 22, No. 267, pp. 587–593.) The impedances of various cylindrical and conical aerials were measured by the resonant line method and are presented graphically. The dependence of the properties of a cylindrical dipole on its diameter is shown. The impedances of a conical unipole with a reflecting sheet and of a conical dipole are shown for the frequency range 200–1 000 Mc/s. The apparent impedance of a cylindrical dipole fed from a concentric cable with and without a $\lambda/4$ balancing transformer is investigated. The accuracy of measurement is limited by reflections from nearby objects and by stray capacitances, and it tends to be poor when the measured resistance is of the same order as the characteristic impedance of the measuring line. For the measuring apparatus see 1113 and 3973 of 1945. See also 3525 and 3605 of 1945.

621.396.674 **289**

Airloop Antenna.—(*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, p. 114.) A novel manufacturing process, whereby a multiturn loop is pressed out of a copper sheet onto a supporting insulating sheet, results in a loop of high Q, because the formed turns stand out in inverted-V fashion and are substantially air-spaced.

621.396.677 **290**

Antenna.—C. W. Hansel. (*Radio*, Oct. 1945, Vol. 29, No. 10, p. 39.) Combination of two V-antennae to obtain a directive system with broadband characteristics. Summary of U.S. Patent No. 2 379 706.

621.396.677 **291**

Polar Diagrams for Antennas.—J. S. McPetrie, L. H. Ford & J. A. Saxton. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 170, 174.) Summary of 2612 of 1945.

621.392 **292**

High Frequency Transmission Lines [Book Review].—W. Jackson. Methuen, London, 1945, 152 pp., 6s. (*Nature, Lond.*, 9th June 1945, Vol. 155, No. 3945, p. 681.) The author "has supplied a real need by providing a convenient and reasonably comprehensive monograph . . ."

CIRCUITS

621.3.011 : 531 **293**

Electromechanical Analogies.—A. Bloch. (*Nature, Lond.*, 4th Aug. 1945, Vol. 156, No. 3953, pp. 151–152.) Brief account of 3277 of 1945.

621.3.012.3 : 621.3.017.21 **294**

Loss due to Series Resistance between Matched Source and Sink.—(*Radio*, Oct. 1945, Vol. 29, No. 10, p. 38.) Chart with explanatory diagram.

621.314.2 **295**

Methods of Driving Push-Pull Amplifiers.—(*Electronic Engng*, Dec. 1945, Vol. 17, No. 214, pp. 816–817.) Four diagrams show the transformer, triode phase-splitter, paraphase, and "out-of-balance" methods.

621.314.2 : 578.088.7 **296**

Biological Amplifiers—2.—D. H. Parnum. (*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 373–376.) Two-valve compressor stages are described for connecting a push-pull input stage to a single-ended amplifier. Interstage coupling for good l.f. response and the advantages of battery power supply are discussed, and the conclusions are applied to a suggested design for a complete amplifier. For part 1 see 45 of January.

621.392.4 **297**

Historic Firsts : Balancing Networks.—(*Bell Lab. Rec.*, Nov. 1945, Vol. 23, No. 11, pp. 412–413.) In early repeater stations loaded artificial lines were used to balance the impedance of real lines.

621.392.5 **298**

[Isolating] **Network Design.**—J. K. Mackenzie. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 20..24.) Summary of 3822 of 1945.

621.392.52 **299**

Preferred Numbers [and filter design].—M. N. McLean. (*Wireless Engr*, Dec. 1945, Vol. 22, No. 267, p. 594.) A letter pointing out an error in 3823 of 1945 (H. Jefferson) and Jefferson's reply.

621.394/.396].645.33 **300**

Improved Driver Stages for Class-B Amplifiers.—Henry. (*See* 262.)

621.394/.396].645.33 **301**

AC/DC Quality Amplifier.—(*See* 261.)

621.394/.396].645.33 **302**

Parallel Tube High Fidelity Amplifier.—Jones. (*See* 263.)

621.395.665 **303**

Elimination of Relative Spectral Energy Distortion in Electronic Compressors.—Miller. (*See* 274.)

621.395.665.1 **304**

Volume Expansion.—J. G. White. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 24–25.) Summary of 3489 of 1945.

621.396.611.3 **305**

Know Your Coupled Circuits.—D. Espy. (*QST*, Oct. 1945, Vol. 29, No. 10, pp. 76–80.) The double-tuned transformer is analysed and easy reference charts are given.

621.396.615.11 **306**

Resistance-Capacity Oscillator.—F. G. Clifford. (*Radio,* Oct. 1945, Vol. 29, No. 10, pp. 16..18.) Summary of 2989 of 1945.

621.396.615.17 **307**

The Equivalent Circuit of the Multivibrator.—G.W.O.H. (*Wireless Engr,* Dec. 1945, Vol. 22, No. 267, pp. 573–575.) Discussion of the treatment of the multivibrator by Kiebert and Inglis (3494 of 1945) in which the valves are represented by switched resistances. The charge and discharge processes are conveniently calculated by the application of Helmholtz's (Thévenin's) theorem. The effect of grid current is approximately represented by the switching of a 1 000 Ω resistance in a typical numerical example. The method enables observed wave-forms to be readily interpreted.

621.396.615.17 : 621.317.755 **308**

Time-Base Converter.—H. Moss. (*Wireless Engr,* Dec. 1945, Vol. 22, No. 267, p. 593.) Letter acknowledging anticipation of 3266 of 1945 in a B.B.C. patent (B.P. 566 102).

621.396.616 **309**

On the Forced Electromagnetic Oscillations in Spherical Resonators.—Rydbeck. (*See* 320.)

621.396.619 **310**

The Input and Efficiency of Class B Modulators.—R. M. W. Grant. (*Marconi Rev.,* July/Sept. 1945, Vol. 8, No. 78, pp. 96–104.) " It is shown that even with linear characteristics the level of quiescent anode current has an important bearing on the distortion produced, and that bottom-bend curvature of the valve characteristics reduces this distortion. Valve rating is also discussed." Measurements are described, made on a pair of CAT 20 valves at 1 kc/s with output powers in the range 9 to 76 kW.

621.396.619.1 **311**

Keying of Radio Frequency Transmitters.—Wassell. (*See* 480.)

GENERAL PHYSICS

534.13 **312**

Wave Equations for Finite Elastic Strains.—H. M. James & E. Guth. (*J. appl. Phys.,* Oct. 1945, Vol. 16, No. 10, pp. 643–644.) Brief note suggesting error in 2822 of 1945 (Nadai).

535.3 + 621.396.11 **313**

An Exact Theoretical Treatment of Reflection-Reducing Optical Coatings.—R. L. Mooney. (*J. opt. Soc. Amer.,* Sept. 1945, Vol. 35, No. 9, pp. 574–583.) Exact formulae for reflectivity, R, and transmittivity, T, are obtained by treating the problem as a boundary problem in electromagnetic theory. General formulae for R and T are given for coatings consisting of a single homogeneous transparent film of uniform thickness. Formulae are also given for the minimum reflectivity for a monolayer coating and for the values of R and T for a beam of light perpendicularly incident on a plane surface of a transparent medium covered by two transparent homogeneous films of different thicknesses and indices of refraction. The general expressions for R and T for two-layer coatings are given, and it is shown that a maximum value of T is obtained when the thickness of each coating is one quarter-wavelength.

538.566.2 : 535.338 **314**

The Doppler Effect in a Refracting Medium.—I. M. Frank. (*Bull. Acad. Sci. U.R.S.S.,* Sér. phys., 1942, Vol. 6, Nos. 1/2, pp. 3–31. In Russian.) The radiation in the optical range of the spectrum from an oscillating electrical dipole (excited atom) moving in a uniform refracting medium is considered. In the method used a moving source of light, radiating spherical waves from different points of its trajectory, is replaced by a number of stationary sources radiating light impulses at definite instants. The theory of the method is discussed, and the Doppler formula (3,4) is derived, which differs from the usual formula (1,1) by the inclusion of the refractive index. A qualitative analysis of the mathematical interpretation is given and the intensity distribution of the radiation spectrum is examined. The case of a dipole moving in a medium without dispersion is discussed and formulae (4,4) determining the field of the dipole are derived. The Doppler effect for very high velocities is then considered and it is shown that since dispersion always exists in a real medium a complex effect may take place if condition (5,5) is fulfilled, *i.e.* a source of monochromatic light moving uniformly may radiate in a given direction not one but several Doppler frequencies. As in practice velocities approaching that of light cannot be attained an examination is made of the possibility of observing the complex Doppler effect in the case of an atom moving in a rarefied gas with a velocity much lower than *c*. The required numerical values are calculated for the cases of sodium in sodium vapour and hydrogen in lithium vapour. The radiation spectrum of a dipole moving in a gas is also considered. Finally the radiation from a dipole moving in a refracting medium with a velocity exceeding the velocity of light for that medium is discussed. It is known that an electron moving with such a velocity radiates light in a certain direction (Cherenkov effect) and necessary conditions are established for an analogous effect to take place in the case of a dipole. The basic principles of an optical model for illustrating the method used in this paper are indicated.

621.315.54 **315**

Electrical Resistance of Liquid [alkali] **Metals.**—Krishnan & Bhatia. (*See* 342.)

621.318.32.017.31 : 538.54 **316**

On the Theory of Eddy Currents in Plane Metal Sheets in the Rayleigh Region.—Rüdiger & Schlechtweg. (*See* 353.)

621.319.7 : 621.385.833 **317**

Potential Distributions of Equal Coaxial Cylinders.—R. D. Hill. (*J. sci. Instrum.,* Nov. 1945, Vol. 22, No. 11, pp. 221–222.) From experimental plots of the field between two electrodes end-to-end, using an electrolytic tank, empirical formulae have been derived for the axial potential in terms of the axial distance and the electrode geometrical factors.

621.384.6 **318**

Radiation from a Group of Electrons Moving in a Circular Orbit.—McMillan. (*See* 440.)

621.396.11 : 535.42 **319**

The Theory of Diffraction.—F. B. Pidduck. (*Phys. Rev.,* 1st/15th Sept. 1945, Vol. 68, Nos. 5/6, p. 142.) Brief note on theoretical work to replace the restricted methods based on Kirchhoff's integral. Anticipatory mention of book " Currents in Aerials and High Frequency Networks " by Pidduck (Clarendon Press, Oxford).

621.396.616 **320**

On the Forced Electromagnetic Oscillations in Spherical Resonators.—O. E. H. Rydbeck. (*Ark. Mat. Astr. Fys.*, 14th Nov. 1945, Vol. 32, Part 3, Section A, No. 11, 18 pp. In English.) A detailed mathematical analysis of the response of the space enclosed by two concentric spheres to excitation by means of a current loop (TE waves) and by a dipole current element (TM waves). The case of a simple hollow sphere is included by assigning to the inner sphere the same medium constants as for the dielectric space. Formulae are given for the intensities of the various modes in terms of the material constants of the space and the boundaries and the location of the exciting loop. The effects of a second loop, terminated by a known impedance, are also evaluated, and also the mutual impedance or coupling between the loops. An equivalent network for the mth resonance of the nth mode of a high-Q hollow sphere with two inserted current loops is derived and illustrated.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.165 + 537.591 **321**

Cosmic Rays.—(*Nature, Lond.*, 3rd Nov. 1945, Vol. 156, No. 3966, pp. 543–544.) Summary of discussion at an Anglo-French Conference on Cosmic Rays held at Bristol University during September 1945.

523.165 **322**

Determination of Orbits in the Field of a Magnetic Dipole, with Applications to the Theory of the Diurnal Variation of Cosmic Radiation.—K. G. Malmfors. (*Ark. Mat. Astr. Fys.*, 14th Nov. 1945, Vol. 32, Part 3, Section A, No. 8, 64 pp. In English.) A knowledge of the trajectories of charged particles in the earth's magnetic field is relevant to the theory of the aurora and to certain cosmic radiation problems. The paper describes an experimental investigation of this subject. See also 3471 of 1945. A magnetized Al-Ni-Co steel ball, 10 cm in diameter was used to represent the earth, and an electron gun was mounted in the vicinity of the surface. The whole assembly was so mounted inside a cylindrical brass vacuum chamber that any desired orientation of the beam relative to the sphere could be obtained. A fluorescent screen at one end of the cylindrical chamber was used to determine the deflection of the beam from its original path.

The main conclusion with regard to cosmic radiation is " it would seem improbable that the difference in diurnal variation arises from particles of energy less than 10^{10} eV, and it accordingly follows therefrom, that the magnetic field of the Sun cannot be the cause of this variation. If the working hypothesis of the isotropic distribution of cosmic radiation in space is not exactly fulfilled, it would appear that therein resides one possibility for explaining the effect as observed."

523.72 **323**

Departure of Long-Wave Solar Radiation from Black-Body Intensity.—E. V. Appleton. (*Nature, Lond.*, 3rd Nov. 1945, Vol. 156, No. 3966, pp. 534–535.) Comment on 1028 and 3252 of 1945 " . . . there is evidence . . . which suggests that during periods of marked solar activity the sun occasionally emits radiation in the radio spectrum greatly in excess of black-body radiation corresponding to 6 000°K."

523.746.5 **324**

A Forecast of Solar Activity.—W. Gleissberg. (*Nature, Lond.*, 3rd Nov. 1945, Vol. 156, No. 3966, p. 539.) The next maximum in sunspot activity will probably be the greatest within living memory. It is likely to be reached before May 1948.

LOCATION AND AIDS TO NAVIGATION

621.3 (41) " 1939/1945 " **325**

British Electrical Engineers and the Second World War.—Dunsheath. (*See* 415.)

621.396 **326**

Radio in the U.S. Navy.—(*See* 417.)

621.396.9 **327**

The Pioneers of Electromagnetic Detection [Radar] **in Great Britain.**—S. Cripps. (*Onde élect.*, Nov. 1945, Vol. 20/25, No. 224, pp. 128–131.) Based on 3909 of 1945.

621.396.9 **328**

Fundamentals of Radar—3. Radar as a Weapon of Offence : ASV and H2S.—(*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 363–365.) A description of the systems for the detection of surface vessels from aircraft (ASV), and for the electronic reproduction of a map of the terrain beneath an aircraft (H2S). First started on a wavelength of $1\frac{1}{2}$ m, these systems were later improved by the use of centimetre wavelengths. The beam shape is such that equal echoes are received from similar targets at any positions within the range of the instruments. Later improvements on H2S introduce a correction for the height of the aircraft and yield an undistorted map instead of a " slant-range " map. For parts 1 and 2 see 3903 of 1945 and 85 of January.

621.396.9 **329**

Radar.—(*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 35–37.) Nine photographs of U.S. Army ground locators SCR 268 and SCR 547 for controlling anti-aircraft guns and searchlights.

621.396.9 **330**

Practical Radar : Part 6.—J. McQuay. (*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 41..99.) Technical details of methods of displaying target information. The special requirements of cathode-ray tubes used in radar are given, and the generation of linear, circular and spiral time bases is described. The indication of echoes by either electrostatic or electromagnetic deflection or by intensity modulation of the beam leads to the display of one coordinate by simple deflection of the linear or circular time base, or two coordinates by the raster method, using intensity modulation. The plan position indicator with synchronized rotating aerial and radial time base is explained. A glossary of radar terms is appended.

621.396.9 **331**

A Radio Navigational Aid.—(*Nature, Lond.*, 3rd Nov. 1945, Vol. 156, No. 3966, p. 542.) A brief description of a device developed by the Decca Navigator Co., involving measurement of phase differences between ground signals received from two or more fixed long-wave transmitters. The accuracy is about 200 yards at 300 miles, and is better for shorter ranges.

621.396.9 **332**

Detection of Birds by Radar.—D. Lack & G. C. Varley. (*Nature, Lond.*, 13th Oct. 1945, Vol. 156, No. 3963, p. 446.) Letter giving evidence of radar echoes from birds (gulls, geese, and starlings) travelling at speeds of about 30 mph which were frequently confused with fast-moving ships. See also 333.

621.396.9 **333**

Detection of Birds by Radar.—H. A. C. McKay. (*Nature, Lond.*, 24th Nov. 1945, Vol. 156, No. 3969, p. 629.) Letter containing quotations from a German document about " spurious echoes " which the present writer attributes to birds. The Germans appear to think the echoes were due to layers in the atmosphere. See also 332.

621.396.9 : 534.321.9 **334**

Acoustic Control in the Flight of Bats.—Hartridge. (*See* 258.)

621.396.9 : 534.88 **335**

Safeguarding our Seaways—The Modern Nautical Chart.—A. L. Shalowitz. (*Sci. Mon., N.Y.*, Oct. 1945, Vol. 61, No. 4, pp. 249–264.) Includes an account of the Radio-Acoustic-Ranging method for determining geographic position when out of sight of land. The sound wave from a bomb exploded under water by the survey ship is received by a hydrophone attached to an anchored sono-radio buoy. This wave causes a radio signal to be transmitted by the buoy for reception at the survey ship, where observation is made of the delay between the explosion and the received signal.

621.396.9 : 629.13 **336**

Timing [high-speed aircraft] **by Radar.**—H. B. D. (*See* 397.)

621.396.931/.933].2 : 621.396.61 **337**

Calibrating Transmitters, Types TV.10, TV.11 and TV.12.—M. D. Tooley. (*Marconi Rev.*, July/Sept. 1945, Vol. 8, No. 78, pp. 89–95.) The low-power portable transmitters are designed for use at d.f. stations, and provide a vertically-polarized signal. In each transmitter type, provision is made for c.w., m.c.w., and keyed operation, with a frequency stability of " not worse than 0.1% after an initial warming-up period ". Each type operates from a 6 V car battery, a built-in vibra-pack with a full-wave cold-cathode rectifier is used to provide high-tension supply. Type TV.10 covers the frequency range 5.8–30 Mc/s in four bands; a five-section tubular aerial is used. Type TV.11 covers the band 0.15–1.5 Mc/s in four bands, and is designed to work with an L aerial. Type TV.12 operating in the band 30–80 Mc/s, uses an aerial similar to that used with the TV.10. Full circuit details are given.

MATERIALS AND SUBSIDIARY TECHNIQUES

549.514.1 **338**

Optical Methods for Determining the Orientation of Quartz Crystals.—R. S. Rivlin. (*J. sci. Instrum.*, Nov. 1945, Vol. 22, No. 11, p. 221.) A reflection method for finding the direction of the *a*-axis on a ground surface of quartz parallel to the (0001)-plane by observation of scintillations when the crystal surface is rotated in its own plane. Accuracy is increased by the deposition of a silver film on the surface.

549.514.1 **339**

Quartz Crystals.—In the UDC numbers for abstracts 91, 92 and 126 of January, for 594.514.1 read 549.514.1.

621.3.047.43 (23.03) **340**

Carbon-Brush Contact Films.—R. H. Savage. (*Gen. elect. Rev.*, Oct. 1945, Vol. 48, No. 10, pp. 13–20.) A carbon brush sliding on copper in vacuum shows high friction and rate of wear which is stopped instantly by water vapour at a pressure greater than 3 mm Hg. Solid adjuvants (CdI_2 or $PbCl_2$) in the brush reduce the vapour pressure required to 0.1–0.2 mm Hg. The glazed film of carbon found on copper surfaces is formed at normal humidities and will maintain the low friction condition for a short period at low humidity, *e.g.* in high-altitude flying. Measurements with a blast of water vapour on the collector surface showed that the average water molecule evaporates from a carbon surface in less than 10^{-3} sec, and a calculation supported by tests gives 0.7×10^{-6} sec.

621.315.2 **341**

Some New Features of Low-Voltage Cable.—L. D. Madsen & R. B. McKinley. (*Gen. elect. Rev.*, Oct. 1945, Vol. 48, No. 10, pp. 44–47.) An outline of various types of insulated cables for power distribution, and the advantages of overhead cables over bare wires. Use of polyvinyl chloride and chloroprene on rubber insulation reduces breakdown risks on underground cables. Polyvinyl chloride has been used to protect 11 kV busbars.

621.315.54 **342**

Electrical Resistance of Liquid [Alkali] **Metals.**—K. S. Krishnan & A. B. Bhatia. (*Nature, Lond.*, 27th Oct. 1945, Vol. 156, No. 3965, pp. 503–504.) A theoretical explanation is considered for the observed increase of about 50% which occurs on melting.

621.315.54 : 621.316.849 **343**

Resistivity of Thin Metallic Films.—A. Van Itterbeek & L. De Greve. (*Nature, Lond.*, 24th Nov. 1945, Vol. 156, No. 3969, pp. 634–635.) Measurements at different temperatures on the temperature coefficient of resistance of nickel films between 20 and 700 mμ in thickness, show a sudden discontinuity at 358°C. Thin films less than 40 mμ possess a negative temperature coefficient.

621.315.55 **344**

Aluminium Alloys as Conductors.—A. Schulze. (*Arch. tech. Messen*, Oct. 1943, No. 148, T.122.) A condensed account of the properties of alloys containing different proportions of Si, Fe, Ca, and Mg, in relation to their use for overhead transmission lines. The mechanical strength and electrical conductivities for several alloys are given graphically and in tables. The properties of Aldrey are given in detail.

621.315.59 **345**

The Electrical Properties of Semi-Conductors.—R. J. Maurer. (*J. appl. Phys.*, Oct. 1945, Vol. 16, No. 10, pp. 563–570.) Experiments which have yielded information regarding the behaviour of electrons in semi-conductors are reviewed. Evidence based on measurement of electrical conductivity, the Hall effect and thermoelectric effects are discussed, together with data dealing with departures from stoichiometric proportions in the lattice of the substance concerned. "Deviations from stoichiometric proportions are the most important type of 'impurity' which one has to consider when dealing with the electrical properties of semi-conducting compounds. There are available physical-chemical methods by which, in favorable cases, the degree of disorder may be determined as a function of the equilibrium conditions. The combination of these measurements with the determination of the electrical conductivity, σ, and the Hall constant, R, enables one to deduce the mean free path and the density of conducting particles as a function of the degree of disorder and of the temperature."

621.315.59 **346**

The Basic Principles of Semi-Conductors.—F. Seitz. (*J. appl. Phys.*, Oct. 1945, Vol. 16, No. 10, pp. 553–563.) A review of typical deviations from ordinary valence rules by alloys and inorganic compounds, and of the effect on the electrical properties of a compound of a deviation from stoichiometric proportions. The value of information obtained from electrical measurements is illustrated by reference to several semi-conducting compounds.

621.315.612.4 **347**

Dielectric Constants of Some Titanates.—B. Wul. (*Nature, Lond.*, 20th Oct. 1945, Vol. 156, No. 3964, p. 480.) The permittivities of Be, Mg, Ca, Zn, Sr, Cd and Ba titanates, measured at room temperature at 1 Mc/s, ranged from 17 for Mg to greater than 1 000 for Ba. A curve shows the large variation in permittivity of barium titanate with temperature over the range −200 to + 300° C.

621.315.613.1 **348**

Synthetic Mica.—(*Elect. Rev., Lond.*, 7th Dec. 1945, Vol. 137, No. 3550, p. 826.) Notice of two reports (one British, one American) issued by the Mica Trade Association, on German manufacture of synthetic mica and substitute materials.

621.315.616.9+679.5](213) **349**

Properties of Plastics [in Tropical Conditions].—S. Rogerson: W. J. Tucker: P. I. Smith. (*Electronic Engng*, Sept. 1945, Vol. 17, No. 211, p. 698.) Correspondence arising from 3044 and 3359 of 1945.

621.315.616.9 : 536.41 **350**

Thermal Expansion and Second-Order Transition Effects in High Polymers, Part II. Theory.—R. F. Boyer & R. S. Spencer. (*J. appl. Phys.*, Oct. 1945, Vol. 16, No. 10, pp. 594–607.) "The nature of the thermal expansion anomaly in high polymers, known as the second-order transition, is examined in some detail. It is suggested that below the transition temperature, Tm, polymer chains can expand sidewards but not parallel to their length. At Tm lengthwise expansion becomes prominent, thus accounting for the sudden increase in thermal expansion. Experimental results are presented showing the anisotropic expansion of oriented polymers below Tm. The transition effect is then treated as a problem in viscous flow, which gives rise to various semi-empirical plots connecting Tm with applied forces, plasticizer content, and time effects. The brittle point, T_b, involves highly elastic deformation, and is shown to be a fundamentally different test, although Tm and T_b are sometimes numerically equal. Various factors influencing the brittle point are reviewed briefly." For part I, see 3605 of 1944.

621.315.616.9 : 541.64 **351**

Molecular Weight Studies on High Polymers with the Electron Microscope.—R. F. Boyer & R. D. Heidenreich. (*J. appl. Phys.*, Oct. 1945, Vol. 16, No. 10, pp. 621–639.) A technique is described for isolating single polymer molecules, and examining them under the microscope. Circular particles 15–500 A in diameter have been observed, and are believed to represent single molecules. The relation between diameter and molecular weight is reviewed in detail. "The data appear to favor the concept of a random coil to the extent that particle diameter varies as the square root of the molecular weight. The molecular weight distribution curves obtained are of the expected shape and extent, although the average molecular weights computed from the distribution curves are 4–5 times greater than values measured by an independent method. Finally, the role of electrical charges in stabilizing isolated polymer molecules is discussed."

621.315.617.3 **352**

Insulating Varnishes.—(*Elect. Rev., Lond.*, 14th Dec. 1945, Vol. 137, No. 3551, p. 857.) Short report of a discussion by the Radio Section I.E.E., led by C. R. Pye. "Probably the type most likely to come into general use would be based on 'Silicone' polymers . . ."

621.318.32.017.31 : 538.54 **353**

On the Theory of Eddy Currents in Plane Metal Sheets in the Rayleigh Region.—O. Rüdiger & H. Schlechtweg. (*Arch. Elektrotech.*, Jan./Feb. 1944, Vol. 38, Nos. 1/2, pp. 42–56.) Starting from the Rayleigh expression $B = \mu_a H + \frac{\alpha}{2} H^2$ for weak fields, the differential equation for the field distribution in a metal sheet is approximately solved. The current density and eddy-current loss are then determined. The loss is separable into two parts, one corresponding to permeability independent of field strength, and the other proportional to α. Functions required for practical application are given in graphs. Numerical examples are worked out. The loss proportional to α can, in some cases, be only a small fraction of the total, but it can be substantial for silicon alloys, and for those of the Permalloy type.

621.318.322 : 538.27 **354**

Increase of Initial Permeability due to Elastic Stress.—K. Sixtus. (*Naturwissenschaften*, Feb./March, 1944, Vol. 32, Nos. 5/13, pp. 73–74.) A brief report of experiments showing the effect of slight bending on the permeability of Fe–Si (3% Si) stampings. For alternating fields of the order of 0.01 Oersted the permeability was increased by factors up to 1.5. For strong fields the permeability was slightly reduced.

621.385.832 + 535.37 **355**

On the Question of the Upper Temperature Limit of the Luminescence of Phosphors.—Brauer. (*See* 447.)

621.52 **356**

High-Vacuum Pumps. — R. Witty. (*J. sci. Instrum.*, Nov. 1945, Vol. 22, No. 11, pp. 201–206.) A description of two types of rotary oil pump, and the principles of operation of diffusion pumps, with an outline of the construction of some modern types.

621.52 **357**

Use of Silicones as Diffusion Pump Oils.—G. P. Brown. (*Rev. sci. Instrum.*, Nov. 1945, Vol. 16, No. 11, pp. 316–318.) Two silicones, a straight hydrocarbon (Litton C), an ester (Octoil) and a chlorinated aromatic hydrocarbon (Narcoil) were compared for performance in a nonfractionating diffusion pump. The high-boiling silicone produces the highest vacuum, as indicated by an untrapped ionization gauge, and is almost completely free from oxidation when exposed to air while hot. A table showing the relative merits of the oils is given.

621.791.3 **358**

Self-Soldering.—(*Wireless World*, Dec. 1945, Vol. 51, No. 12, p. 387.) A short note on a device for soldering telephone cables in the field. A small copper tube contains cored solder, and has a combustible material on the outer surface. The ends of the wire are twisted and inserted in the tube, and the outer material is ignited by striking on the packing box as if it were a match.

679.5 **359**

Modern Plastics [Book Review].—H. Barron. Chapman & Hall, London, 1945, 680 pp., 42s. (*Engineering, Lond.*, 19th Oct. 1945, Vol. 160, No. 4162, p. 303 ; *Beama J.*, Oct. 1945, Vol. 52, No. 10, pp. 338–339.) A text-book for the general scientific or technical reader, rather than for the specialist.

MATHEMATICS

517.942.9 **360**

The Laplace Equation.—E. Kasner & J. De Cicco. (*Science*, 7th Sept. 1945, Vol. 102, No. 2645, pp. 256–257.) Letter on some difficulties involved in transformation of the three-dimensional equation.

518.5 **361**

A New Type of Differential Analyzer.—V. Bush & S. H. Caldwell. (*J. Franklin Inst.*, Oct. 1945, Vol. 240, No. 4, pp. 255–326.) The instrument incorporates features of proven merit from earlier designs, but has greater precision, scope and flexibility. It can be used by investigators working either locally or at a distance.

531.314 : 621.385 **362**

Dynamics of Electron Beams.—D. Gabor. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 792–805.) Hamiltonian dynamics are presented in their two less familiar forms, *viz.*, the canonical equations expressing the energy of motion of a particle in terms of its position and momentum, and the Hamilton-Jacobi equation, expressing motion in terms of an action function when the momentum is irrotational. This covers all cases of electron motion in electrostatic fields, and in electromagnetic fields having no component normal to the cathode. The equations can be applied to the motion not only of a single electron but also to that of a regular stream of electrons.

The method can be used for graphical and numerical approximate solutions of electron motion, or for the inverse problem of designing the field to produce a certain desired type of motion. The Hamilton-Jacobi equation also lends itself to the treatment of small perturbations caused by changes in the electromagnetic field.

Transit-time effects are dealt with by transforming the equation into one symmetrical in time and space coordinates, and this is shown to be equivalent to the principle involved in phase-focusing. The case of electrons with random motion is dealt with by introduction of Hamilton's phase-space and inclusion of a density distribution term in the canonical equations.

These methods provide useful tools for determining solutions of the more general problems, and for developing solutions for special cases of the more complex problems of electron beams.

621.385 **363**

Space Charge between Coaxial Cylinders.—Page & Adams. (*See* 485.)

MEASUREMENTS AND TEST GEAR

621.3.012.3 : 621.3.017.21 **364**

Loss due to Series Resistance between Matched Source and Sink.—(*Radio*, Oct. 1945, Vol. 29, No. 10, p. 38.) Chart with explanatory diagram.

621.317.32 **365**

Sphere-Gaps : Irradiation and Impulse-Voltage Measurement.—J. M. Meek. (*Elect. Rev., Lond.*, 30th Nov. 1945, Vol. 137, No. 3549, p. 778.) Short account of a paper and discussion at the I.E.E. An investigation has shown the need for some revision of the B.S. rules for measurement with sphere-gaps. Irradiation (*e.g.* by insertion of radium in the high-voltage sphere) is necessary to avoid errors in the measurement of impulse voltages.

621.317.33 : 621.396.662.2 **366**

Simplified Coil Testing.—G. T. Clack. (*Electronic Engng*, Dec. 1945, Vol. 17, No. 214, pp. 829–832.) Simple circuits are given for testing resistance, insulation, and inductance, involving only a milliammeter and valve voltmeter as measuring instruments. The latter should be of good stability with an operating range up to 20 Mc/s. Inductance methods given include direct measurement at l.f., comparator bridge, oscillator and valve-voltmeter, and dynatron. For production testing, comparison with a standard coil frequently offers the most convenient method.

621.317.332 : 621.315.14 **367**

A Method of Measuring the Radiofrequency Resistance of Wires.—C. Stewart, Jr. (*J. appl. Phys.*, Oct. 1945, Vol. 16, No. 10, pp. 608–614.) A coaxial transmission line 10–100 ft long, with the wire under test as the inner conductor and a metal tube as the sheath, is short-circuited at one end and connected at the other to a commercial Q-meter.

Conditions are chosen so that the line impedance is inductive at the test frequency, and so that errors introduced by the Q-meter internal resistance are minimized. The theory of the method, which is suitable for use in the frequency range 0.2 to 40 Mc/s, is given in detail. The technique " appears to be more reliable than the use of coils, assuming all precautions just described to be taken and considering commercial test equipment commercially available at present. Also the results of this method agree closely with those of calculations by skin effect formulas."

621.317.35 **368**

The Short-Time-Constant Circuit.—M. G. Scroggie. (*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 358–361.) The application of a square-wave signal to an R-C circuit with a short time constant is investigated by Fourier analysis, the waveform of the voltage across the resistor being derived, and compared with experimental observation. A demonstration of the principle of wave analysis.

621.317.361 **369**

Frequency Measuring System.—H. O. Peterson. (*Radio*, Oct. 1945, Vol. 29, No. 10, p. 40.) A system for combining harmonics and sub-harmonics of a crystal oscillator to produce a wide range of controlled frequencies by decade switching. Summary of U.S. Patent No. 2 380 868.

621.317.361 : 621.396.615.17 **370**

Automatic Control for Locked Oscillator.—McCool. (*See* 474.)

621.317.39.082.7 **371**

An Electrical Moisture Meter.—Hartshorn & Wilson. (*See* 388.)

621.317.42.089.6 **372**

Note on Calibration of Grassot Fluxmeters.—R. S. J. Spilsbury & C. E. Webb. (*J. sci. Instrum.*, Nov. 1945, Vol. 22, No. 11, pp. 213–215.) " Small discrepancies in the calibration of fluxmeters were traced to differences in the time interval between break and make of the reversing switches employed. Similar variations in the deflexion produced by a given change of linkage were found to occur when the rate of fall of the coil in a Hibbert Magnetic Standard was altered, and it is concluded that the effect depends on the velocity attained by the moving coil of the fluxmeter and hence implies variability in the damping coefficient. The avoidance of errors arising from this effect, by the choice of a suitable calibration procedure, is important if the fluxmeter is to be used for measurements of high precision."

621.317.715 **373**

A Galvanometer Amplifying System of Great Sensitivity.—D. C. Gall. (*J. sci. Instrum.*, Nov. 1945, Vol. 22, No. 11, pp. 218–219.) " A double . . . system using a photocell and thyratron . . . The sensitivity of the galvanometer is increased by positive mechanical feed-back and the circuit stabilized by negative electrical feed-back. It enables fractions of a microvolt to be recorded."

621.317.723 **374**

Measurement of High Voltages.—J. M. Meek & F. W. Waterton. (*Nature, Lond.*, 6th Oct. 1945, Vol. 156, No. 3962, pp. 422–423.) An attracted-disk electrometer for absolute measurement of a.c. or d.c. voltages up to 100 kV with an accuracy of 0.3% is operated in a continuously-evacuated system to avoid breakdown, convection currents, and effects of dust and humidity.

621.317.725 + 621.317.734] : 621.385 **375**

Electronic Volt-Ohmmeter.—H. H. Arnold. (*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 48..132.) A sensitive valve voltmeter using a large-scale meter of low sensitivity. The circuit is of an unbalanced bridge type, two valves in adjacent arms acting as a phase inverter to give a linear scale. Use of a cathode-follower stage gives input impedance 30–300 MΩ. The ohmmeter section employs a voltage-dividing network. Ranges 0–6 000 V in six ranges beginning 0–6 V, and 0.1–5.10^8 Ω.

621.317.726 : 621.385 **376**

A High Impedance Pulse Voltmeter.—D. E. Howes. (*Rev. sci. Instrum.*, Nov. 1945, Vol. 16, No. 11, p. 322.) A cathode-coupled amplifier is connected to a conventional diode rectifier, using a single 6SN7 (double triode) for the two purposes. The advantages are a high input impedance with a comparatively low output impedance. The instrument responds equally well to pulses from one to 20 μs in length.

621.317.726 : 621.385 **377**

A Voltmeter for Complex Waveforms.—C. H. Banthorpe. (*J. Televis. Soc.*, Dec. 1944, Vol. 4, No. 4, pp. 90–91.) For waves of amplitudes up to 200 V peak-to-peak. The voltage to be measured is applied through a cathode-coupled amplifier to a cathode-ray tube, on which the measurement is made.

The circuit gives a flat response for frequencies up to about 2.5 Mc/s.

621.317.73 **378**

Impedance Bridge with a 10^9 to 1 Range.—(*Nature, Lond.*, 24th Nov. 1945, Vol. 156, No. 3969, pp. 639–640.) Summary of 2285 of 1945. (H. T. Wilhelm.)

621.317.733 + 536.531].087.6 **379**

An Automatic Recorder for Resistance Thermometry.—D. R. Stull. (*Rev. sci. Instrum.*, Nov. 1945, Vol. 16, No. 11, pp. 318–321.) Measurement of temperature to ± 0.01° C with a platinum resistance thermometer requires resistance measurement to ± 0.001 Ω. A standard 10 inch chart recorder will cover a range of 1 Ω, or 10°C, with this accuracy. The Wheatstone bridge including the thermometer is balanced automatically by a 1 Ω slider, the arm of which carries the recording pen. At the ends of its travel an additional 1 Ω from a decade bank is automatically switched in or out as required. The selector switch on the 1 Ω bank of coils at the ends of its travel operates similarly, by a Geneva gear mechanism, the selector switch of a decade bank of 10 Ω resistance coils. A second pen records the positions of the decade resistance selector switches. The range covered is from −190° C to 550° C.

621.317.738 + 621.317.79 **380**

New Types of Test Gear for Television Production.—P. D. Saw. (*J. Televis. Soc.*, Dec. 1944, Vol. 4, No. 4, pp. 76–81.) A description of a reactance comparator and alignment oscillator designed for unskilled operators. The comparator contains an oscillator loosely coupled to a tuned circuit. The resonance frequency of the tuned circuit is varied rapidly about its mean value in synchronism with the movement of a pointer over a scale. The p.d. developed across the circuit when it is in tune with the oscillator operates stroboscopic illumination of the pointer and scale. The pointer appears to be at rest in a position depending on the difference between the oscillator frequency and the mean frequency of the resonant circuit. The components to be tested can be connected to either the oscillator circuit or to the coupled tuned circuit, and components with the same reactance cause the pointer to appear at rest in the same position. For an oscillator frequency of 500 kc/s reactance differences of 0.1 $\mu\mu$F can be observed.

The alignment oscillator generates a signal with mean frequency adjustable from 35 to 50 Mc/s, frequency modulated at 50 c/s over a range of a few Mc/s. There is a buffer output stage. A stable frequency-calibrating oscillator is also provided.

621.317.79 : 621.385 **381**

Vacuum Tube Analyzer.—L. G. Sands. (*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 38..85.) An instrument for checking valve characteristics. Tests on emission, gas current, noise, and transconductance can be made, the latter by using an oscillator to drive the test valve, with a null method of measurement. Voltage supplies for all electrodes are incorporated and are fully variable. Constructional details are included.

621.396.67 : 621.317.33 **382**

Aerial Impedance Measurements. — Essen & Oliver. (*See* 288.)

621.396.67.082 **383**

Technic of Antenna Gain Measurements.—Glinski. (*See* 287.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.714.7 : 621.317.39 **384**

An Electrical Micrometer.—D. C. Gall. (*J. sci. Instrum.*, Nov. 1945, Vol. 22, No. 11, p. 219.) A method of measuring very small displacements by the use of electrical resistance strain gauges attached to a micrometer head. By means of an amplifier, an ink record of the displacement can be made. Full-scale galvanometer deflexion for 0.001 inch.

544.62 : 621.383.8 **385**

An Application of Multiplier Photo-Tubes to the Spectrochemical Analysis of a Magnesium Alloy.—G. A. Nahstoll & F. R. Bryan. (*J. opt. Soc. Amer.*, Oct. 1945, Vol. 35, No. 10, pp. 646–650.)

578.088.7 : 621.314.3 **386**

Biological Amplifiers.—Parnum. (*See* 296.)

621.315.1[/.5] : 621.317.3.082.78 **387**

A Splice Detector for Army Field Wire.—F. S. Hird. (*Bell Lab. Rec.*, Nov. 1945, Vol. 23, No. 11, pp. 424–426.) Another account of 140 of January.

621.317.39.082.7 **388**

An Electrical Moisture Meter.—L. Hartshorn & W. Wilson. (*J. Instn elect. Engrs*, Part II, Oct. 1945, Vol. 92, No. 29, pp. 403–412. Discussion pp. 412–415.) For use with grains, seeds, fabrics, etc. An alternating voltage is applied to the material in a suitably-designed " cell". The current passing through the cell is measured by means of a sensitive thermionic ammeter of special construction, which can be adjusted to read the capacitance current, proportional to the dielectric constant of the material, the conductance current, proportional to its a.c. conductivity, or some function of both these currents chosen to give the most favourable variation with moisture content.

621.318.57 + 621.3.083.7 **389**

Electronic Mechanism for Measurement and Control in Plant and Industry.—T. A. Cohen. (*Instruments*, April 1945, p. 228.) A light disk attached to the pointer of a measuring instrument moves near coils in the grid circuit of an oscillator, causing large changes of anode current. Abstract in *Electronic Engng*, Dec. 1945, Vol. 17, No. 214, p. 836.

621.365 : 621.383 **390**

An Automatic Furnace Discharge Indicator.—(*Beama J.*, Oct. 1945, Vol. 52, No. 10, p. 331.) In a roller hearth electric furnace the moving charge interrupts a light beam and a photoelectric relay mechanism gives warning that the charge is ready to be removed from the furnace.

621.365.5 + 621.365.92 **391**

Radio Heating in Industry.—(*S. Afr. Engng*, Dec. 1945, Vol. 56, No. 12, pp. 284–285.) Elementary account, with reference to an exhibition of equipment dealt with in 4158 of 1945.

621.365.52 : 534.321.9 : 669 **392**

Degassing of Metal Alloys.—W. Esmarch, T. Rommel & K. Benther. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 166, 170.) Summary of a German paper. See also 2048 of 1945, and *Electronic Engng*, July 1945, Vol. 17, No. 209.

621.365.92 : 664.84 **393**

The Electronic Blanching of Vegetables.—J. C. Moyer & E. Stotz. (*Science*, 20th July 1945, Vol. 102, No. 2638, pp. 68–69.) The process gives only 3% loss of ascorbic acid compared with 30–40% for steam or boiling-water blanching. Vegetables in retail cartons are passed between electrodes from a 750 W 150 Mc/s oscillator.

621.365.92 : 679.5.023 **394**

H. F. Heating in Heatronic Moulding.—A. E. L. Jervis. (*Electronic Engng*, Dec. 1945, Vol. 17, No. 214, pp. 819–824.) H.f. heating has advantages for the softening of thermo-setting plastics for moulding. The more uniform heating gives better quality with fewer rejects, there is the possibility of producing more complicated shapes, and the cost is lower. These factors are considered in some detail.

621.385.833 **395**

The Preparation of Specimens for the Electron Microscope.—D. G. Drummond. (*Electronic Engng*, Dec. 1945, Vol. 17, No. 214, pp. 807–809.)

621.396.91 **396**

Flight Similitude Tests of Radiosondes.—National Bureau of Standards. (*J. Franklin Inst.*, Oct. 1945, Vol. 240, No. 4, p. 335.) Samples of mass-produced radiosondes are tested in a chamber in which the ambient pressure and temperature and the ventilation can be made to simulate flight conditions. A short note.

629.13 : 621.396.9 **397**

Timing [high-speed aircraft] **by Radar.**—H. B. D. (*Wireless World*, Dec. 1945, Vol. 51, No. 12, p. 376.) The aircraft flies towards the radar installation and the limits of the course over which its speed is measured are marked by signals generated inside the equipment to simulate echoes from the beginning and end of the course. The coincidence of these signals with echoes from the aircraft mark the beginning and end of the timing operation, which is carried out by counting the pulses emitted by the radar transmitter during the interval, the pulse repetition frequency being known.

629.135 : 621.38 **398**

Electronics at the R.A.E. [Royal Aircraft Establishment] **Exhibition.**—(*Electronic Engng*, Dec. 1945, Vol. 17, No. 214, pp. 810–813.) Measurements of vibration frequencies and amplitudes, accelerations, and static and dynamic strains in structures are among the aircraft constructors' problems that are best solved by electronic means. The pick-up unit is of first importance. Strains are measured by wire resistance gauges; vibrations by a piezoelectric crystal, an electro-magnetic generator, an eddy-current pick-up, or a variable inductance. Capacitors are used to determine torsional vibrations or pressure. Cathode ray tubes or recorders present the information given by the pick-up. The exhibits included items developed by aircraft and instrument firms, by the R.A.E. and by other Ministry of Aircraft Production experimental establishments.

PROPAGATION OF WAVES

621.396.11 + 535.3 **399**

An Exact Theoretical Treatment of Reflection-Reducing Optical Coatings.—Mooney. (*See* 313.)

621.396.11 **400**

Graphical Determination of the Horizon.—W. H. Anderson. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 35..64.) Estimation of optical range over land by drawing the profile of the transmission path with suitably adjusted scales for the radius of the earth and height above sea level.

621.396.11 : 535.42 **401**

The Theory of Diffraction.—Pidduck. (*See* 319.)

621.396.11.029.64 + 621.396.24 + 621.385.1 **402**

Simultaneous Use of Two New Radiocommunication Techniques: Centimetre Waves and Frequency Modulation.—A.-G. Clavier & V. Altovsky. (*Bull. Soc. franç. Élect.*, March 1944, Vol. 4, No. 35, pp. 85–97.) By taking advantage of the special features of centimetre waves (sharp directivity, wide-range modulation), the company "Le Matériel Téléphonique" have been able to realize a multichannel radio-telephony system which "can be inserted in a long-distance telephony traffic system without infringing national standards" (a "hertzian cable"). This result has been obtained by using frequency modulation, negative feed-back, and frequency compression. The authors consider that this terminal technique is now so satisfactory that the use of such centimetre-wave systems will in future be limited only by propagation characteristics.

Experiments carried out in 1941 are described, in which these propagation characteristics were "for the first time" confirmed by observation.

In experiments on sources, the L.M.T. had, in 1939, developed a wave-guide magnetron giving a few milliwatts at a wavelength of 9 mm, but for the long-distance communication experiments a 10 cm velocity-modulation tube was used, giving about 3 W useful output from a horn radiator. A similar tube giving 100 W was developed in 1940–1941, and another giving 25 W at 5 cm wavelength was developed in 1942.

The sender was located at a point on the coast about 700 m above sea level, giving a horizon of about 100 km. The receiver, using a similar horn, was in a specially constructed cabin on board a boat. Up to the horizon, the field strength was inversely proportional to the distance, and at this limit was some 30–35 db above the level needed by the limiter stage of the f.m. receiver. (A recorder in front of the limiter stage gave a measure of relative field strength.) During this first voyage the weather was fine and warm, and the sea calm, as it had been for some time. Beyond the line of sight, the recorder showed pronounced, though not rapid, fluctuations of field strength, with maxima reaching nearly to the line-of-sight level, and minima approaching, but not passing, the minimum level required by the limiter. These fluctuations did not affect the received modulation (speech, music, and pure tone), as frequency modulation was being used—an important practical consideration. This behaviour continued to about 190 km from the sender (90 km beyond the horizon), when the prearranged programme terminated before the limiting distance had been reached.

In some later voyages over the same route, but in bad weather, there was a rapid and fairly uniform fall of field strength beyond the horizon, with loss of contact at about 170 km. In one case both types of variation were observed at different periods.

It is concluded that although a horizontal stratification of optical characteristics may give abnormally long ranges under certain weather conditions, the range of reliable communication on centimetre wavelengths is the horizon of the sender.

621.396.11.029.64 : 551.51.052 **403**

On the Effect of Refraction in the Troposphere on the Propagation of Ultra-Short Radio Waves in a Diffraction Zone.—B. A. Vvedenski (Wwedensky). (*Bull. Acad. Sci. U.R.S.S.*, Sér. phys., 1942, Vol. 6, Nos. 1/2, pp. 41–55. In Russian.) Refraction and diffraction affect the propagation of radio waves of all wavelengths, but the relative importance of each of the two factors varies with the wavelength, and in the case of ultra-short waves refraction becomes predominantly important. A detailed mathematical investigation is presented in which both diffraction and refraction are taken into account, and a formula (6,1) is derived for determining the field due to a vertical elementary dipole radiating ultra-short waves, *i.e.* the case of vertical polarization only is considered, although with minor mathematical adjustments the case of horizontal polarization could also be covered. In order to simplify the necessary calculations, curves published in a previous work by the author, dealing with the purely diffraction problem, could be used.

The following two main conclusions are reached: (a) owing to the presence of refraction the vertical component of the field beyond the horizon may be either smaller or greater than if refraction were absent. This contradicts the commonly accepted notion, due to the indiscriminate introduction of optico-geometrical conceptions into the diffraction formula, that refraction always increases the field component, (b) fading undoubtedly occurs. See also 394 of 1945.

621.396.8.029.63/.64 **404**

Microwave Transmission Power Requirements.—Browder & Young. (*See* 482.)

RECEPTION

621.396.61.029.58 **405**

Engineering British B48 Walkie Talkies.—(*See* 467.)

621.396.61/.62].029.62 **406**

Converting 112-Mc Gear for 144.—Rand : Bradley. (*See* 469.)

621.396.62 **407**

A 21-Tube All-Purpose Receiver.—J. Marshall. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 31–37, 114.) A detailed description of a receiver intended to be equally suitable for high-selectivity long-range communication and for high-fidelity reproduction of broadcast transmission, with provision for phonograph, microphone, and recording facilities.

621.396.621.53 **408**

Conversion Diagrams for Triode Tube Mixers.—H. Stockman. (*J. appl. Phys.*, Oct. 1945, Vol. 16, No. 10, pp. 639–642.) Measurements are described using a grounded-grid acorn valve operated in the grounded-grid condition, the signal and heterodyning voltages being derived from low-impedance sources. I.f. output is measured with a specially designed voltmeter, with a tuned circuit at the input terminals. Ten such circuits are provided, which together cover a wide impedance range ; any one of these input circuits may be selected by a suitable switching operation. It is thus possible to determine the optimum mixer bias and load impedance necessary to give maximum power output at i.f. The i.f. used is 450 kc/s and examples of experimental results for a signal frequency of 7 Mc/s are included. Noise considerations are excluded from discussion. " It is understood that the . . . diagrams and curves [given] do not completely describe the operation of a triode tube mixer but merely serve to indicate how the operation may be studied . . ." For previous work see 1522 of 1944 and 778 and 2600 of 1945.

621.396.621.53.029.62 **409**

Home Constructed 112 Mc Receiver.—J. Gavin & S. Heytow. (*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 29..129.) A superheterodyne receiver using conventional circuits and valves. Constructional details of the 15 Mc/s i.f. transformers are given.

621.396.621.53.029.62 **410**

112 Mc. Converter.—R. Frank. (*Radio News*, Nov. 1945, Vol. 35, No. 5, pp. 46..78.) Design and constructional details of a unit including a twin triode as local oscillator and mixer to give an i.f. of 20 Mc/s. This is connected to a suitable communications receiver.

621.396.621.53.029.62 **411**

A Four-Tube Superheterodyne for 144 Mc.—B. Goodman. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 27–30, 108.) A super-regenerative second detector is used. This combination is claimed to be free from some of the disadvantages of the straight super-regenerative circuit, *e.g.* lack of selectivity and undesired antenna reaction, and receiver radiation. Constructional details are given.

621.396.645.33 **412**

Audio Section Design Data for Battery Operated Receivers.—Sylvania Electric Products, Inc., Engineering Dept. (*See* 279.)

621.397.62 **413**

Extended-Range Television Reception : Part I.—Wilder. (*See* 463.)

621.396/.397].62 **414**

Radio Receiver Design, Part II [Book Review].—K. R. Sturley. Chapman & Hall, London, 480 pp., 28s. (*Wireless Engr*, Dec. 1945, Vol. 22, No. 267, p. 586.) An inadequate chapter on television " mars an otherwise excellent book ". For reviews of Part I see 2893 of 1944.

STATIONS AND COMMUNICATION SYSTEMS

621.3(41) " 1939/1945 " **415**

British Electrical Engineers and the Second World War—P. Dunsheath. (*Engineer, Lond.*, 12th & 19th Oct. 1945, Vol. 180, Nos. 4683 & 4684, pp. 280–281 & 302–305.) Long summary of I.E.E. Presidential address, containing a brief account of the war activities of the Post Office, *e.g.* jamming of German army radio communications ; reception and re-radiation of German air navigation signals to mislead hostile aircraft ; crystal control of groups of broadcasting stations on identical frequencies to prevent their use for air navigation ; great expansion of emergency home communication routes, particularly the 1 + 3 system (one audio and three carrier-frequency channels). The main developments of radar are also described.

621.391.1 **416**

Multichannel Communication Systems.—F. F. Roberts & J. C. Simmonds. (*Wireless Engr*, Dec. 1945, Vol. 22, No. 267, pp. 576–580.) Part II of a paper dealt with in 183 of January. Detailed descriptions are given of the oscillator, phase divider, pulse generator and modulator units of the transmitter, and the synchronizing and demodulating units of the receiver. Results obtained with the experimental apparatus are given. Cross-talk was 42 db between adjacent channels and 45 db to other channels ; on speech, cross-talk was audible but unintelligible, and with a large number of channels could be classed as noise. The effective audio band was 200–3 500 c/s.

621.396 **417**

Radio in the U.S. Navy.—(*QST*, Oct. 1945, Vol. 29, No. 10, pp. 14–64.) Four articles by members of the U.S. Navy describing Naval radio communications in all its branches, and Radar, with numerous photographs of air-borne and sea-borne equipment, training stations, etc.

621.396.24 + 621.396.11.029.64 + 621.385.1 **418**

Simultaneous Use of Two New Radiocommunication Techniques : Centimetre Waves and Frequency Modulation.—Clavier & Altovsky. (*See* 402.)

621.396.61 **419**

War Reporting Equipment used by the B.B.C.—Richardson & Walker. (*See* 466.)

621.396.61.029.64 **420**

Army Set No. 10.—(*See* 470.)

621.396.619 **421**

Pulse-Width Modulation.—(*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 361–362.) Description of the basic principles. Good reproduction can be achieved using only two pulses per cycle of the highest modulation frequency transmitted. Several channels may be superimposed on a single carrier by inserting the pulses of one channel in the intervals of the remaining channels.

621.396.641.1/.2 **422**

The Outlook for Radio Relaying.—R. Bown. (*Bell Lab. Rec.*, Oct. 1945, Vol. 23, No. 10, pp. 365–367.) Wire telephony has, in the past, been of higher quality than radio telephony due to the advantages of directivity, available frequency spectrum, and relative freedom from noise and transmission disturbances. In these respects microwave radio is comparable with wired circuits, and it seems possible that microwave telephony links can have quality comparable with wire telephony.

621.396.8.029.63/.64 **423**

Microwave Transmission Power Requirements.—Browder & Young. (*See* 482.)

621.396.97.029.62 **424**

U.H.F. and Post-War Broadcasting.—K. I. Jones & D. A. Bell. (*J. Televis. Soc.*, Mar. 1944, Vol. 4, No. 1, pp. 6–9.) Opening contribution to an I.E.E. discussion, 2344 of 1944.

SUBSIDIARY APPARATUS

518.5 **425**

A New Type of Differential Analyzer.—Bush & Caldwell. (*See* 361.)

620.193(213) : 621.396.6 **426**

Tropic-Proof Components : A Reader's Experience [in Malaya].—R. C. Joyce. (*Electronic Engng*, Sept. 1945, Vol. 17, No. 211, p. 698.)

621.315.2 : 621.317.333.4 **427**

A Simple Method of Locating Insulating Faults Affecting All Conductors in a Cable.—H. Weber. (*Tech. Mitt. schweiz. Telegr. Teleph. Verw.*, 1st April 1945, Vol. 23, No. 2, pp. 51–55. In both French and German.)

621.315.2 : 621.317.333.4 **428**

On the Location of Insulation Faults in Cables.—C. Lancoud. (*Tech. Mitt. schweiz. Telegr. Teleph. Verw.*, 1st April 1945, Vol. 23, No. 2, pp. 56–74. In both French and German.)

621.315.2 : 621.317.79 **429**

The Lookator.—J. T. Schott. (*Bell Lab. Rec.*, Oct. 1945, Vol. 23, No. 10, pp. 379–383.) A device using pulse technique to locate faults in transmission lines. Pulses are applied to the line and the fault, being a discontinuity, gives reflected pulses which are displayed on a c.r. tube. The distance of the fault is derived from the time delay of the reflected pulse, and the form of the trace often gives good indication of the type of fault.

621.315.212.1 : 621.316.54 **430**

A Simple Coaxial Switch.—Burgess. (*See* 283.)

621.315.221 : 620.193.7 **431**

Study of A.C. Sheath Currents and their Effect on Lead-Cable-Sheath Corrosion.—Sherer & Granbois. (*See* 511.)

621.315.221 : 620.193.7 **432**

Electrolysis and Corrosion of Underground Power-System Cables.—Gorman. (*See* 510.)

621.316.849 : 621.315.54 **433**

Resistivity of Thin Metallic Films.—Van Itterbeek & De Greve. (*See* 343.)

621.317.733 + 536.531].087.6 **434**

An Automatic Recorder for Resistance Thermometry.—Stull. (*See* 379.)

621.318.42 **435**

The Design of H. F. Chokes.—V. J. Cooper. (*Marconi Rev.*, July/Sept. 1945, Vol. 8, No. 78, pp. 105–112.) An account of the design of simple single-layer unscreened solenoid chokes based on an examination of the characteristics of a large number of them. Curves are given which enable the lowest order anti-resonant and resonant frequencies to be derived from the choke dimensions and length of wire used. Wavelength range considered, 6–300 m.

621.319.7 : 621.385.833 **436**

Potential Distributions of Equal Coaxial Cylinders.—Hill. (*See* 317.)

621.383.2 **437**

The Colour Response of [emissive] **Photoelectric Cells.**—A. Sommer. (*J. Televis. Soc.*, Sept. 1944, Vol. 4, No. 3, pp. 51–57.) Simple theory and properties of emission photo-electric cells. Einstein's equation for the conversion of energy of radiation into electronic energy gives the relation $V = 12\,336/\lambda$, where V is the velocity of an emitted electron in electron-volts, and λ is the wavelength of the incident light in Angstrom units.

The conditions for high photo-electric emission are capacity for absorption of light, availability of loosely bound electrons, low work function, and the substance must be neither a good insulator nor a good conductor. The manufacture of the silver-oxygen-caesium cell and of the antimony-caesium cell are described, and their spectral responses explained.

The choice of cells for particular light sources is discussed. The normal practice of defining sensitivity in terms of response to lumens of incident light is shown to be faulty : it is better to match the spectral emission curve of the light source to the performance curves of the available photo-cells. Examples are given of correct matches, using the performance curves of cells in common use.

621.384.6 **438**

A 100-Million Volt Induction Electron Accelerator.—W. F. Westendorp & E. E. Charlton. (*J. appl. Phys.*, Oct. 1945, Vol. 16, No. 10, pp. 581–593.) " The plan and construction of a device capable of accelerating electrons to energies as high as 100 million electron volts are described together with the special building to house it. A more detailed description of the device and its construction will appear in the *General Electric Review*. The accelerator has a pole face 76 inches in diameter, weighs 130 tons, and operates on 60-cycle current requiring at full load 200 kilowatts. The machine is air cooled and is capable of continuous operation at full voltage . . ." Loading difficulties introduced by small variations in the supply frequency are described, together with the method evolved of avoiding such troubles. Measurements made on the output of X-rays under continuous and pulsed operation are detailed.

621.384.6 **439**

The Synchrotron – A Proposed High Energy Particle Accelerator.—E. M. McMillan. (*Phys. Rev.*, 1st/15th Sept. 1945, Vol. 68, Nos. 5/6, pp. 143–144.) A device related to the cyclotron offering the possibility of reaching energy in the 10^9eV range with either electrons or heavy particles.

621.384.6 **440**

Radiation from a Group of Electrons Moving in a Circular Orbit.—E. M. McMillan. (*Phys. Rev.*, 1st/15th Sept. 1945, Vol. 68, Nos. 5/6, pp. 144–145.) When a concentrated group of electrons moves in a circular orbit the radiation loss will not seriously affect the operation of the " synchrotron ".

621.396.611 **441**

Air-Seal Test Set for [Quartz] **Crystal Units.**—G. W. Willard. (*Bell Lab. Rec.*, Oct. 1945, Vol. 23, No. 10, pp. 361–364.) Quartz crystal plate holders for use in arctic or tropical conditions must be sealed, and a routine test is necessary to detect air holes in the seal. The holders are placed in a chamber that is exhausted for a specified period. A high voltage is then applied to the terminals of the crystals and the value of the ionization current, which depends on the pressure within the holder, indicates whether leakage has taken place.

621.396.662.2 : 621.317.33 **442**

Simplified Coil Testing.—Clack. (*See* 366.)

621.319.45 **443**

The Electrolytic Capacitor [Book Review].—A. M. Georgiev. Murray Hill Books, New York, 191 pp., $3.00. (*Radio News*, Nov. 1945, Vol. 34, No. 5, p. 62.) " . . . a comprehensive study of the design, construction, manufacture, function, and testing . . ." For another review see 4005 of 1945.

TELEVISION AND PHOTOTELEGRAPHY

621.317.738 + 621.317.79 **444**

New Types of Test Gear for Television Production.—Saw. (*See* 380.)

621.383 : 621.397.611 **445**

The Isoscope : A Slow-Electron Image Analyser.—R. Barthélemy. (*Onde élect.*, Nov. 1945, Vols. 20/25, No. 224, pp. 103–115.) The author calls attention to the drawbacks of the Iconoscope—particularly those due to unwanted secondary emission. " It is interesting to note how unlikely it was, in view of this emission, that this device would ever be satisfactory." He then gives a fairly long account of the Orthiconoscope (Radio Corporation) in which the desired minimization of secondary emission was sought by using a slow-speed electron beam, with electric deflexion, magnetic focusing and an axial direction. This necessitated a transparent mosaic and various other modifications of the original Iconoscope assembly. It has its own drawbacks, which are enumerated, but " the balance is nevertheless very favourable to the use of slow-speed electrons ".

In view of the difficulty of getting uniform intensity over the whole mosaic with electric deflexion, the author has studied the possibility of magnetic deflexion, and, in conjunction with Paumier, Monnot and Bobenrieth, has developed a new tube of this type giving improved uniformity of definition, whence the name " Isoscope".

Further, taking advantage of the fact that the slow-speed beam can be made to give up to 100% modulation in the output circuit, some experiments have been made on the high-frequency modulation of the beam itself, so that a vision-modulation high-frequency (10 Mc/s) carrier is available at the output, leading to a simplification of the subsequent amplification process. To avoid direct excitation of the output electrode and circuit at the carrier frequency, the latter is obtained as the difference between two higher frequencies applied respectively to the cathode and the Wehnelt tube of the gun, or alternatively, to the Wehnelt tube and the output electrode of the mosaic. " All the difficulties have not yet been resolved, but the first applications of the Isoscope with high-frequency modulation are full of promise."

621.383.2 **446**

The Colour Response of Photoelectric Cells.—Sommer. (*See* 437.)

621.385.832 + 535.37 **447**

On the Question of the Upper Temperature Limit of the Luminescence of Phosphors.—P. Brauer. (*Naturwissenschaften*, Jan. 1944, Vol. 32, Nos. 1/4, p. 32.) A short note stating that a phosphor containing more than one activator has an upper temperature limit of luminescence that is different for each of the activators.

621.385.832 : 621.397.62 **448**

" Telechrome " [c.r.t. for colour television].—J. L. Baird. (*J. Televis. Soc.*, Sept. 1944, Vol. 4, No. 3, pp. 58–59.) This tube uses a separate electron beam for each colour reproduced. For two colours the two cathode-ray beams scan the opposite sides of a thin plate of transparent mica, one side being coated with a phosphor giving one colour and the other side with a phosphor giving the other colour. For three colours, one side of the screen is ridged to provide the requisite number of surfaces.

A new form of scanning reduces colour flicker by introducing colour alteration at every line instead of the present practice of changing the colour only with each successive frame.

621.396.9 **449**

Practical Radar : Part 6 [Display systems].—McQuay. (*See* 330.)

621.396.97.029.62 **450**

U.H.F. and Post-War Broadcasting.—Jones & Bell. (*See* 424.)

621.397 **451**

Color Television.—P. C. Goldmark, J. N. Dyer, E. R. Piore, & J. M. Hollywood. (*J. Soc. Mot. Pict. Engrs*, Apr. 1942, Vol. 38, No. 4, pp. 311–354.) See 481 of 1943.

621.397 **452**

Colour Television, Part II.—P. C. Goldmark, E. R. Piore, J. M. Hollywood, T. H. Chambers & J. J. Reeves. (*J. Televis. Soc.*, Mar. 1944, Vol. 4, No. 1, pp. 19–24.) Long summary of 3452 of 1943.

621.397 **453**

Television Terms and Definitions.—(*J. Televis. Soc.*, Sept. 1944, Vol. 4, No. 3, pp. 65–67.) About 40 terms taken from B.S.204:1943 of the British Standards Institution.

621.397 **454**

Objectives for Post-War Television.—W. Miner. (*J. Televis. Soc.*, Mar. 1944, Vol. 4, No. 1, pp. 13–16.) Reprint of 1628 of 1944.

621.397 **455**

A Survey of the Problems of Post-War Television.—B. J. Edwards. (*J. Televis. Soc.*, Mar. 1944, Vol. 4, No. 1, pp. 10–12.) Extract from 1109 of 1945.

621.397 **456**

Post-War Television.—British Institution of Radio Engineers. (*J. Televis. Soc.*, Sept. 1944, Vol. 4, No. 3, p. 71.) An extract from " Report on Post-War Development in the Radio Industry". It is proposed that the service should be broadcast, not wired; that carrier frequencies and video bandwidth should be of the same order as in pre-war practice. Vestigial side-band transmission, a 25% increase in the number of lines per frame, and a maximum modulation frequency of 3.25 Mc/s, are also suggested. The sound transmission should be part of a nation-wide u.h.f. high-quality sound service.

621.397 **457**

American Proposed Standards for Post-War Television.—(*J. Televis. Soc.*, Dec. 1944, Vol. 4, No. 4, pp. 94–96.) Reprint of 846 of 1945.

621.397 **458**

Television after the War.—O. J. Russell. (*J. Televis. Soc.*, Sept. 1944, Vol. 4, No. 3, pp. 60–63.) A plea that the technical development of television should not exclude its progress as an art; that it should attempt to produce its own art form, rather than imitate cinema practice. In particular, it is suggested that a screen ratio of height/width of 3/2 would be aesthetically satisfying for use with the type of subject most appropriate to television and would give technical advantages in improved definition without increase of band width. A table shows the improvement in definition possible in plain, stereoscopic and colour images by using different frame ratios.

621.397 **459**

The Pye " Videosonic " Television System.—D. I. Lawson. (*Electronic Engng*, Dec. 1945, Vol. 17, No. 214, pp. 814–815.) An account of the system described in 230 of January. See also *Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 371–372.

621.397.61 **460**

Mobile Television Equipment.—R. L. Campbell, R. E. Kessler, R. E. Rutherford & K. V. Landsberg. (*J. Soc. Mot. Pict. Engrs*, July 1942, Vol. 39, No. 1, pp. 22–36.) Description of an equipment comprising 15 light-weight units including (a) Synchronizing generator (2 units) incorporating a monitoring c.r.o., supplying signals for horizontal sweep, vertical sweep, composite blanking and composite synch. Several camera chains may be controlled by one generator. (b) Camera control unit, using a 5-stage video amplifier. Two blanking slippers are operated by means of low-impedance diode limiters. The video output from the camera has a high-level cathode-loaded stage for use with the amplifier, and a low-level stage for the electronic view-finder and monitor.

621.397.62 **461**

Problems of Theater Television Projection Equipment.—A. H. Rosenthal. (*J. Soc. Mot. Pict. Engrs*, Sept. 1945, Vol. 45, No. 3, pp. 218–240.) Light storage and light modulation of a standard source are necessary to obtain theatre television projection comparable with motion picture projection. In the Supersonic system, supersonic waves of frequency 10–20 Mc/s are created in a liquid by a piezoelectric plate excited by an electronic oscillator, which is amplitude modulated by the television signals. Light from a standard source is passed through the liquid and is diffracted an amount dependent upon the amplitude of the supersonic waves. With a liquid column of 2 inches about 250 picture elements of a 525-line frame can be projected simultaneously. The movement of the picture elements across the projection screen can be stopped by the use of a rotating mirror polygon to give a compensating movement. This system has been used regularly on a commercial scale.

In another system being developed, light from a standard source is passed through the screen of a Skiatron tube; the amount of light transmitted by any portion of the screen is varied by scanning the screen with a television-signal-modulated cathode-ray beam. A high storage effect is obtained by retaining the transmission values unchanged over the frame period.

Both systems can be readily adapted for colour television by the additive successive colour method by placing a small filter disk in the optical system where the light beam is small. The Skiatron system can also be used with the more efficient subtractive successive-colour method by passing the light through successive screens of suitable materials.

621.397.62 **462**

Some Aspects of Large Screen Television.—T. M. C. Lance. (*J. Televis. Soc.*, Dec. 1944, Vol. 4, No. 4, pp. 82–88. Discussion p. 89.) A brief description of Baird's and Karolus's bank of lamps giving low-definition projection, and of the Kurt Rosenberg system using cinema films projected onto a bank of 1 026 photocells at 20 frames a second, in which each cell is connected to the grid of a mercury-gas triode and excites four 6 W lamps on a large sign board. The board consisting of 4 104 lamps measures 30 × 20 ft and consumes 10 kW on full modulation.

Methods of projecting high-definition c.r. screens are discussed, and a brief description given of a method of applying the Schmidt camera for illuminating a 15 × 20 ft screen.

After a brief description of Diavisors, the Rosenthal system, and the proposed Donal and Langmuir projection system, a description is given of Fisher's equipment developed in Switzerland. Light from a powerful source passes through two grids, between which there is a liquid film 0.1 mm thick; the grids are arranged so that when the surface is undisturbed light is not transmitted. The surface can be deformed by electrostatic means, and when this occurs refraction of the beam gives an output which is a function of the degree of deformation. Much ancillary equipment is involved and so far no information is available as to the degree of contrast or screen illumination achieved by this method.

621.397.62 **463**
Extended-Range Television Reception : Part 1.—M. P. Wilder. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 18–22, 112.) A detailed description of a television receiver (51 Mc/s) with which the author has had good reception for a considerable proportion of the transmission time at 90 miles distance and 1 000ft below the line of sight. A noise limiter is an important element. The first of three parts.

621.397.7 **464**
7,000 Hours Experience in Television Service.—H. R. Lubcke. (*J. Televis. Soc.*, Dec. 1945, Vol. 4, No. 4, pp. 91–92.) A synopsis of the development of television technique by the Don Lee Broadcasting System of America (Station W6XAO). A list of references to papers and patent specifications is given. Synopsis of a paper in *Electronic Industries*, July 1944, Vol. 3, No. 7, p. 110.

621.397.7 **465**
Some Engineering Aspects of Portable Television Pick-Ups.—H. R. Lubcke. (*J. Soc. Mot. Pict. Engrs*, Dec. 1942, Vol. 39, No. 6, pp. 384–390.) The experiences at Station W6XAO.

TRANSMISSION

621.396.61 **466**
War Reporting Equipment Used by the B.B.C.—W. D. Richardson & P. H. Walker. (*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 377–379.) During the campaign in Europe mobile transmitters were used by the B.B.C. to transmit news to England. A 500–15 000 kc/s, 250 W, transmitter was mounted on lorries and trailers complete with power supply, stores, and a small studio. Two 7½ kW short-wave sets, less highly mobile, were used for transmitting over the longer distances.

621.396.61.029.58 **467**
Engineering British B48 Walkie Talkies.—*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 104–108..142.) This portable transceiver covering the range 6 to 9 Mc/s follows the main details of its prototype the British Army Wireless Set No. 18. . The space economy of a common antenna coil for both the receiver input and the transmitter tank circuit has been dispensed with resulting in improved electrical performance. The most noteworthy additions are a crystal calibrator and a hand-generating set.

621.396.61.029.62 **468**
An A.M.-F.M. Transmitter for 50 Mc.—E. P. Tilton. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 23–26.) Output 40 W, with crystal or v.f.o. control.

621.396.61[/.62].029.62 **469**
Converting 112-Mc Gear for 144.—P. S. Rand : W. E. Bradley. (*QST*, Oct. 1945, Vol. 29, No. 10, pp. 72–73, 116.) A description of the modifications necessary to operate 112 Mc/s transmitting and receiving equipment on the 144–148 Mc/s band, in particular the Abbott TR-4 and various *QST*-designed units.

621.396.61.029.64 **470**
Army Set No. 10.—(*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 383–384.) The use of centimetre wavelengths for military communications gives high security from interception by the enemy because radiation can be beamed and because surrounding hills form an effective screen. The No. 10 set is a centimetre-wavelength, pulse-modulation, trailer-mounted British army communications equipment that can handle eight speech channels simultaneously.

621.396.611.21 **471**
Harmonics in the Piezo-Electric Oscillation of a Quartz Crystal.—L. C. Tsien & H. C. Chu. (*Nature, Lond.*, 6th Oct. 1945, Vol. 156, No. 3962, p. 424.) A quartz crystal driven by a Hartley oscillator can be forced to vibrate over a wide range of frequencies, especially at $(p + 1) f/2$ where f = crystal fundamental frequency, p = integer ; the odd harmonics are much stronger than the even. In a Pierce circuit with weak feed-back only the fundamental and odd harmonics are obtained.

621.396.611.21 : 621.396.615.14 **472**
Crystal Control in the New Ham Bands.—J. Holmbeck. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 38–39.) A description of heterodyne methods whereby 1.75, 3.5 and 7 Mc/s crystals can be used to control oscillators in the 144, 50 and 21 Mc/s bands.

621.396.615.14 **473**
Getting Acquainted with the "Lighthouse" Tube.—P. S. Rand. (*QST*, Nov. 1945, Vol. 29, No. 11, pp. 11–14.) A simple tuned-line transmitter for the 144, 220 and 420 Mc/s bands. Bands are selected by changes of line length, tuning over the band is by a capacitor at the end of the line.

621.396.615.17 : 621.317.361 **474**
Automatic Control for Locked Oscillator.—W. A. McCool. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 39–40.) Increased stability of a multivibrator with locking-voltage amplitude variations is obtained by supplying a plate voltage derived from the locking signal. Summary of U.S. Patent No. 2 377 894.

621.396.619 **475**
Modulator.—R. C. Shaw. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 42, 58.) High-fidelity amplitude-modulation of a carrier wave is produced by variation of amplifier feedback in accordance with the modulation signal. Summary of U.S. Patent No. 2 379 042.

621.396.619 **476**
The Input and Efficiency of Class B Modulators.—Grant. (*See* 310.)

621.396.619.018.41 **477**
Wave Length Modulation.—M. G. Crosby. (*Radio*, Oct. 1945, Vol. 29, No. 10, p. 42.) A method of obtaining crystal control of a frequency-modulated transmitter. Summary of U.S. Patent No. 2 375 527.

621.396.619.018.41 **478**
A Delay Line Frequency Modulator.—D. Weighton. (*Wireless Engr*, Dec. 1945, Vol. 22, No. 267, pp. 581–586.) A method of phase modulating a crystal-controlled signal giving larger phase deviations than other methods. The crystal-controlled signal is mixed with an f.m. signal from a reactor-valve modulator, and the difference component is passed through a delay line, after which it is mixed with the f.m. signal to give the original centra

frequency as the summation component. The effects of distortion in the reactor-valve modulator and in the delay line are estimated and their influence on design is discussed. For 2% harmonic distortion and a 1 db drop at 10 kc/s a phase shift of not less than 12 radians and probably up to 90 radians can be realized.

621.396.619.018.41 : 621.396.611.21 **479**

Crystal-Controlled Frequency Modulation.—S. K. Lewer. (*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 367–370.) The use of an X-cut quartz crystal to control the frequency of a master oscillator, this frequency being varied by the application to the crystal of voltages at modulation frequency. Adequate frequency deviation may be obtained by frequency multiplication followed by the use of the heterodyne principle, a process which may be repeated several times.

621.396.619.1 **480**

Keying of Radio Frequency Transmitters.—H. J. H. Wassell. (*Marconi Rev.*, July/Sept. 1945, Vol. 8, No. 78, pp. 77–88.) The problems are surveyed and summarized. The desirable characteristics of the radiated signal under c.w., m.c.w., and voice-keyed carrier operation, are considered with particular reference to signal shape, the constancy of the radio frequency, and the elimination of unwanted radiation. Means of equalizing the load on the power supply during space and mark periods are examined. Keying control circuits incorporating design features imposed by the considerations outlined above are described in detail. A short section deals with the provision of "listening through" facilities in hand-speed two-way telegraphy links.

621.396.645.31 **481**

Using the New High-Power Beam Tubes.—D. Mix. (*QST*, Oct. 1945, Vol. 29, No. 10, pp. 67–68, 116.) A description of an amplifier using Eimac 4–125 A screen-grid tubes suitable for 28, 14, 7 and 3.5 Mc/s, and capable of handling a power input of 1 kW, and a two-stage transmitter using HK 257–B pentodes delivering 200 W on the above frequencies.

621.396.8.029.63/.64 **482**

Microwave Transmission Power Requirements.—J. E. Browder & V. J. Young. (*Radio*, Oct. 1945, Vol. 29, No. 10, pp. 30–34, 64..67.) The factors involved in obtaining satisfactory microwave communication are discussed, and a "balance sheet" method of calculation presented. On the "gain" side are oscillator power, gain of transmitting and receiving antennae, and perfect-receiver sensitivity. On the "loss" side are transmitter and receiver cable losses, "isotropic" transmitter and receiver antennae characteristics, propagation loss and receiver noise figures. Typical numerical values of these quantities are given graphically and examples of required transmitter power worked out. The effect of reflection interference on propagation loss is briefly considered.

621.396.931/.933].2 : 621.396.61 **483**

Calibrating Transmitters, Types TV.10, TV.11 and TV.12.—Tooley. (*See* 337.)

VALVES AND THERMIONICS

621.385 **484**

Valve [colour] **Coding.**—K. E. Marcus. (*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 384–385.) A letter adding to 246 of January. Colours for heater ratings, but letters to represent functions.

621.385 **485**

Space Charge between Coaxial Cylinders.—L. Page & N. I. Adams, Jr. (*Phys. Rev.*, 1st/15th Sept. 1945, Vol. 68, Nos. 5/6, pp. 126–129.) "New solutions of the space charge equation are obtained, which converge much more rapidly than Langmuir's solution in the important case where the radius of the outer electrode is large compared with that of the inner electrode."

621.385 : 531.314 **486**

Dynamics of Electron Beams.—Gabor. (*See* 362.)

621.385 : 621.317.79 **487**

Vacuum Tube Analyzer.—Sands. (*See* 381.)

621.385.1 + 621.396.11.029.64 + 621.396.24 **488**

Simultaneous Use of Two New Radiocommunication Techniques : Centimetre Waves and Frequency Modulation.—Clavier & Altovsky. (*See* 402.)

621.385.3 (091) **489**

Saga of the Vacuum Tube : Part 20.—G. F. J. Tyne. (*Radio News*, Nov. 1945, Vol. 34, No. 5, pp. 51..120.) A description of the construction and manufacturing difficulties of some early British valves developed for use during the 1914-18 war.

621.385.34 **490**

Transmitter Valves-I. — M. Matricon, J. Chantereau, R. Montagne & A. Laurent. (*Onde élect.*, Nov. 1945, Vols. 20/25, No. 224, pp. 116–127.) A detailed description of new types and designs of external-anode transmitting valves, and of corresponding new manufacturing techniques developed by the French Thomson-Houston Co.

Distinctive features of these designs are (1) the elimination of any deep concavities in the glass parts of the envelopes, which were inconvenient and ill adapted for cooling: (2) termination of the control grid on a metal ring electrode fused into the glass along its top and bottom edges: (3) the use of pre-formed accurately-moulded glass elements of size and shape suitable for assembly by eddy-current heating, and the complete elimination of the glass-lathe and gas-jet technique.

MISCELLANEOUS

001.891 **491**

The Work of the [British] **Department of Scientific and Industrial Research.**—E. V. Appleton. (*J. roy. Soc. Arts*, 22nd June 1945, Vol. 93, No. 4694, pp. 372–382. Discussion, pp. 382–384.) The Department is responsible for the organization of scientific research over a very wide field. It has established, or controls, ten national research laboratories of which the National Physical Laboratory is the largest, and encourages industrial participation in research through a number of Research Associations. The scope of these laboratories is briefly described and some indication is given of the useful work they have accomplished.

001.891 **492**

A Plan for Research in the United States.—(*Nature, Lond.*, 4th Aug. 1945, Vol. 156, No. 3953, pp. 130–132.) A review of the Bush report "Science—the Endless Frontier". See also 493 below, 4095 of 1945 and back references.

001.891 **493**

Conditions for the Promotion of Research.—(*Nature, Lond.*, 4th Aug. 1945, Vol. 156, No. 3953, pp. 125–128.) Editorial comment on 492 above.

001.891 : 621.38 + 347.771 : 621.396.9 **494**

Some Navy Electronics Problems and a Proposal for a Radar Patent Pool.—J. B. Dow. (*Elect. Engng, N.Y.*, Mar. 1945, Vol. 64, No. 3, pp. 87–91.) A well-organized research programme of adequate scope would maintain the progress made during the war years. More attention should be devoted to standardization of components and to a more thorough testing of their dependability under all conditions of use. If the progress made in radar techniques is to be made generally available without undue delay, a solution of the patent problem is essential, and it might be found in a patent pool.

001.891 (47) **495**

Electrical Research in the U.S.S.R.—G. Oster. (*Proc. Instn Radio Engrs, Aust.*, Aug. 1945, Vol. 6, No. 2, pp. 6–8.) A reprint of 2409 of 1945.

02 **496**

Association of Special Libraries and Information Bureaux: Annual Conference.—(*Nature, Lond.*, 17th Nov. 1945, Vol. 156, No. 3968, pp. 605–607.) Papers and discussions on the planning and equipment of research libraries, links with the U.S.A., reference books, and the circulation of scientific information both as individual papers and in abstract.

06.054 **497**

The Presentation of Technical Developments before Professional Societies.—W. L. Everitt. (*J. Soc. Mot. Pict. Engrs*, Sept. 1945, Vol. 45, No. 3, pp. 184–190.) A reprint from *Proc. Inst. Radio Engrs, N.Y.*, July 1945, Vol. 33, No. 7, p. 423.

061.231 : 62 **498**

The Engineer and his Future.—C. A. Powel. (*Elect. Engng, N.Y.*, Jan. 1945, Vol. 64, No. 1, pp. 14–16.) Engineers have not had sufficient public recognition. There is a need for an association of all branches of the profession, apart from the technical societies, to represent the engineer in civic and state affairs.

061.231 : 62 **499**

Organization of the Engineering Profession.—J. F. Fairman. (*Elect. Engng*, June 1945, Vol. 64, No. 6, pp. 220–223.) The author favours an all-inclusive association of professional engineers with one grade of membership, rather than a federation of existing societies.

172.1 : 62 **500**

Civic Responsibilities of Engineers.—(*Elect. Engng, N.Y.*, July 1945, Vol. 64, No. 7, pp. 251–252.) Wider participation of engineers in public affairs is advocated in this report by an AIEE committee.

347.771 **501**

Invention and Patents.—W. E. Burnand. (*Elect. Rev., Lond.*, 9th Nov. 1945, Vol. 137, No. 3546, pp. 687–688.) The present system discourages invention by high fees, uncertainty as to the protection afforded, certainty of heavy expense in upholding this very uncertain protection, and the apprehension that, if an invention is successfully developed, some prior patent may be discovered that will deprive the inventor of his benefits. It is suggested that special courts be set up consisting of technically-trained persons assisted by legal persons acting only in an advisory capacity. Such courts would make reasonable awards to the inventor, which would be reviewed from time to time, depending upon the value of the invention to the general well-being of the community.

51 : 53 **502**

Mathematical Theory vs. Physical Concept.—E. H. Armstrong. (*Proc. Instn Radio Engrs, Aust.*, July 1945, Vol. 6, No. 1, pp. 12–14). A collection of quotations from text-books and journals in which frequency-modulation was belittled and adversely criticized on theoretical grounds. "It was in the face of these barriers of false conclusions that the experimental method based on physical reasoning laid bare the hidden phenomena which led to the invention of the f.m. system." The author also quotes, however, an article by Carson and Fry which gives a mathematical demonstration and exact calculation of the gain in signal/noise ratio obtainable from f.m. systems, and which incidentally refers to the illusory character of some of the earlier claims.

519.283 **503**

Statistical Tools for Controlling Quality.—J. Manuele & C. Goffman. (*Trans. Amer. Inst. elect. Engrs*, July 1945, Vol. 64, No. 7, pp. 524–528.) An elementary description of how statistical concepts—for example, standard deviation, and average value of a number of observations—may be used to detect aberrations in manufacturing processes.

535.767 : 535.88 **504**

A Stereo-Episcope.—W. E. Curtis & T. A. Littlefield. (*J. sci. Instrum.*, Nov. 1945, Vol. 22, No. 11, pp. 215–218.) The images of a stereoscopic pair projected on a special screen are seen in relief by use of either Anaglyph or Polaroid filters and spectacles. Details of the construction and of the adjustment procedure are given.

551.509 : 621.3 **505**

Meteorology-Aid to Electrical Engineers.—F. J. Mahaffy. (*Elect. Engng, N.Y.*, Aug. 1945, Vol. 64, No. 8, pp. 290–294.) An examination of recent advances that have broadened the range and scope of weather prediction, the factors entering into the forecasting process and of specific meteorological information the electrical industry can expect for aid in both its long-range and day-to-day operations.

6 : 623 **506**

The Influence of Research on Victory in War.—J. C. Ward, Jr. (*Elect. Engng, N.Y.*, April 1945, Vol. 64, No. 4, pp. 133–138.) A short discussion on the relations between American government agencies (ministries) and industry in the fields of research and development, followed by a justification of the need for continuous research. The scale and type of problems encountered during the war in achieving technical superiority over the enemy, are illustrated with examples drawn mainly from the aeronautical field. Statements by various heads of American development laboratories are included, dealing with their particular achievements and future requirements.

6(07) : 62 **507**

Explorations in Engineering Education.—A. B. Bronwell. (*Proc. Inst. Radio Engrs, N.Y.*, Nov. 1945, Vol. 33, No. 11, pp. 735–740.)—Analysis of recommendations from sections of I.R.E. for changes in the system of engineering education required to meet modern needs. Educators in answer suggest three curricula (1) normal training for the majority (2) management and (3) scientific-technical.

614.825 **508**

Safety.—AIEE Committee on Safety. (*Elect. Engng, N.Y.*, Jan. 1945, Vol. 64, No. 1, pp. 44–45.) Electric shocks and burns are a major problem in the power industry. References are given to two recent developments in artificial respiration.

620.193(213) : 621.396.6 **509**

Tropic-Proof Components : A Reader's Experience [in Malaya].—R. C. Joyce. (*Electronic Engng*, Sept. 1945, Vol. 17, No. 211, p. 698.)

620.193.7 : 621.315.221 **510**

Electrolysis and Corrosion of Underground Power-System Cables.—L. J. Gorman. (*Trans. Amer. Inst. elect. Engrs*, June 1945, Vol. 64, No. 6, pp. 329–336.) An account of the extensive experience of the Consolidated Edison Co. of New York on the various types of corrosion to which cables are liable and the best means of their prevention. For discussion see *Trans. Amer. Inst. elect. Engrs*, June Supplement 1945, Vol. 64, pp. 479–482.

620.193.7 : 621.315.221 **511**

Study of A.C. Sheath Currents and their Effect on Lead-Cable-Sheath Corrosion.—C. M. Sheier & K. J. Granbois. (*Trans. Amer. Inst. elect. Engrs*, May 1945, Vol. 64, No. 5, pp. 264–268.) An account of two cases in which the lead sheaths of cables have been corroded through electrolytically, the initial corrosion being accelerated by rectified alternating currents induced in the sheath by the load current. Protection can be obtained by applying to the sheath a small negative bias with respect to earth by means of a dry battery. For discussion see *Trans. Amer. Inst. elect. Engrs*, June Supplement 1945, Vol. 64, pp. 483–484.

621–526 : 621.314 **512**

Servo-Mechanisms.—D. C. Bomberger. (*Bell Lab. Rec.*, Nov. 1945, Vol. 23, No. 11, pp. 409–411.) A servo mechanism is similar in principle to an electronic feed-back amplifier in that a large output power can be controlled by a small signal. Stability problems also are similar in the two devices.

621.3(091) **513**

100 Years of Electricity and Electronics.—V. Zeluff & J. Markus. (*Sci. Amer.*, July 1945, Vol. 173, No. 1, pp. 7..16.) A review of developments in the electrical and electronic industries during the past century. Pioneer work is described on electric lighting, X-ray tubes, wire communication, radio and television. Prospects of the future applications of radar and industrial electronics are discussed.

621.3.017.72 **514**

Contribution to the Problem of the Thermal Circuit in Electrical Machines and Apparatus.—L. Cigánek. (*Arch. Elektrotech.*, Jan./Feb. 1944, Vol. 38, Nos. 1/2, pp. 29–34.) Equations are derived for the temperature distribution in a rectangular bar when heat enters at one end and is all given up to the surrounding medium from the surface of the bar. The cases are then treated of two bars of different section connected in parallel, draining a heat source, and of two bars of different section connected in series to the heat source. Numerical examples of the application of the formulae are worked out, and the temperature distribution at the contact point of a switch is discussed briefly.

621.313 + 621.315] (23.03) **515**

Effect of Altitude on Electric Apparatus.—L. M. Robertson. (*Elect. Engng*, June 1945, Vol. 64, No. 6, pp. 214–216). " Increase of altitude results in decrease of air density, heat dissipation by convection, dielectric strength of air, windage losses, ambient temperature and humidity, and this affects operation of some electric apparatus. Corona loss, lightning currents, commutation, and earth resistance also are affected." The data given chiefly concern the operation of electrical machinery and transmission lines in mountainous districts.

621.315.616.9 + 679.5](213) **516**

Properties of Plastics [in tropical conditions]. S. Rogerson : W. J. Tucker : P. I. Smith. (*Electronic Engng*, Sept. 1945, Vol. 17, No. 211, p. 698.) Correspondence arising from 3044 and 3359 of 1945.

621.327.43 + 621.385.132 **517**

Fluorescent Lamps.—H. G. Jenkins. (*G.E.C. J.*, Aug. 1945, Vol. 13, No. 4, pp. 185–198.) The development of fluorescent lamps is reviewed. The cold-cathode high-voltage types were extensively used before the war and their properties make them suitable for special lighting problems. For more general use, hot-cathode low-voltage types have now been developed, and a description is given of their properties and installation.

621.396 : 134 **518**

Telepathy—Or should it be Radio-Telepathy ?—" Radiophare ". (*Wireless World*, July 1945, Vol. 51, No. 7, pp. 214–216.) A review of some of the evidence for the existence of telepathy, and speculation as to the connection between telepathy and h.f. radiation. See also 4112 of 1945.

621.396.6(213) **519**

Tropical Treatment of Military Equipment.—W. F. Horner & F. R. Koppa. (*Electronic Industr.*, July 1945, Vol. 4, No. 7, pp. 106–108, 150..162.) The two main causes of deterioration are fungoid growths and moisture absorption. The equipment is treated and tested in respect of both effects in a laboratory in which tropical conditions are reproduced. A list of fungicides is given.

621.798(213) **520**

Recommendations for Preserving and Packaging for Tropical Theatres of War.—British Standards Institution. (*British Standard Packaging Code : Supplement 2*, 1944.)

Correction.—In the January abstracts, for *Trans.* [*mon.*] *Amer. Inst. elect. Engrs* read *Trans. Amer. Inst. elect. Engrs*.

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

In order to enhance the usefulness of the abstracts, certain changes have been made in their presentation. The subject sections have been increased in number and made more in accordance with the modern trend of development, and they are now arranged in alphabetical order. Universal Decimal Classification numbers have been added to each abstract, and heavy-face type has been adopted for the serial number and title in order to increase their legibility.

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ACOUSTICS AND AUDIO FREQUENCIES

534.321.9 : 621.396.9 **521**

Acoustic Control in the Flight of Bats.—D. W. Ewer: H. Hartridge: M. Wilkinson. (*Nature, Lond.*, 8th Dec. 1945, Vol. 156, No. 3971, pp. 692–693.) Correspondence following 258 of February (Hartridge).

534.61 **522**

A Method for Obtaining Small Mechanical Vibrations of Known Amplitude.—D. H. Smith. (*Proc. phys. Soc.*, 1st Nov. 1945, Vol. 57, No. 324, pp. 534–542.) The amplitude of a vibrating diaphragm is measured by observing interference fringes between the surface of a thin glass plate attached to the diaphragm and a fixed lens. Theory shows that the fringes disappear for certain critical amplitudes which differ by approximately $\lambda/4$. The amplitude is deduced from the number of times the fringes disappear as the amplitude is raised from zero. The instrument is suitable for a standard source of sound. In favourable circumstances the amplitude can be set to any assigned value by adjusting the current, with an error not greater than 1 in 500.

534.62 **523**

N.Y. Navy Yard's Quiet Room.—W. M. Rees. (*Communications*, Oct. 1945, Vol. 25, No. 10, p. 68.) A description of a room in which ship microphones, telephones, loudspeakers, etc., can be calibrated. The elaborate precautions to ensure the exclusion of external noise and to minimize sound reflection from the walls, ceiling and floor of the room are given in detail.

534.851 **524**

The Error in the Light-Bandwidth Measurement on Gramophone Records.—R. Bierl. (*Akust. Z.*, May 1940, Vol. 5, No. 3, pp. 145–147.) An exact calculation of the theory of light-bands on records gives an expression for the error in the approximate formula given by Buchmann and Meyer (1930 Abstracts, p. 458.) as a two-part correcting term. The first part represents the fact that the extreme reflection point is not at the point of greatest slope, which gives an error not greater than 1%. The second represents an error at small radii, amounting to about 3% for a radius of 4 cm on a 78 turn/min record, and 6% for a 6 cm radius on a $33\frac{1}{3}$ turn/min record.

534.851.6 **525**

Results of Phono Needle Tests.—Consumers Union of U.S. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 99, 143.) Data from *Consumer Reports* on tests for fidelity and record wear of "permanent" gramophone needles. Needles were used for several thousand playings and the increased noise level measured electrically.

534.862.3 **526**

A Multisection Rerecording Equalizer.—W. L. Thayer. (*J. Soc. Mot. Pict. Engrs*, Nov. 1945, Vol. 45, No. 5, pp. 333–338.) "This paper describes an assembly of 5 equalizers [for film recording] arranged so that they can be controlled by one hand, thereby leaving the other hand free for dialogue level adjustments. The equalizers are capable of lowering or raising the response in 5 different frequency bands without creating changes in reproduced level."

621.395.61/.62] : 621.317.39 **527**

Curve-Tracer for Acoustic Devices.—R. K. Hellmann. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 130–133.) The frequency of a beat-frequency oscillator is varied by a motor drive which also actuates a potentiometer controlling the horizontal position of the spot on a long-persistence screen of a cathode ray tube. The beat-frequency oscillator is connected to the acoustic device under test, the sound output being received by an artificial ear and passed through an amplifier to give a vertical deflexion to the cathode ray beam. The response curves obtained in this way have been used for the quality control of full scale production of handset receivers over a period of five years.

621.395.623.7 + 621.396.623 + 534.43 **528**

"High Fidelity".—A. C. Matthews. (*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 33..74.) Data on a wide range of subjective tests are given. The objective requirements in respect of frequency and volume ranges and of noise levels in relation to f.m. transmissions and gramophone reproduction are discussed. Room acoustics and speaker directivity as well as listening habits receive attention. The approach to perfection is finally a matter of economics.

621.395.623.7 : 621.392.53 **529**

Woofer-Tweeter Crossover Network.—P. W. Klipsch. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 144–145.) Details of design of two simple filters operated in parallel as the load for the push-pull triodes of an a.f. amplifier. They are constructed of inexpensive materials and enable a low-frequency horn and a high-frequency horn to be operated together to give a response flat within 2 db in the range 30–10 000 c/s.

621.395.623.8 **530**

An Improved [two-way] **Loudspeaker System for Theaters.**—J. B. Lansing & J. K. Hilliard. (*J. Soc. Mot. Pict. Engrs*, Nov. 1945, Vol. 45, No. 5, pp. 339–349.) "New permanent magnet low-frequency and high-frequency units having replaceable diaphragms are described. These units are combined in a horn system having the following advantages: a higher efficiency, extended frequency range, permanent magnet units providing higher air gap flux densities, elimination of back-stage radiation from the diaphragms, better transient response, and an improved over-all presence."

621.395.623.8 **531**

Sound Distributor.—(*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 25..28.) A non-directional resonator and sound distributor built up from five separate loud speakers arranged round the faces of a 24 inch cubical "reproducing chamber" is claimed to provide musical "depth" by virtue of optimum blending of the separate tonal responses. The acoustical quality is such that this single outlet can replace the usual 25–50 loudspeakers in a large auditorium. Summary of a paper by C. A. Volf (reference not given).

621.395.623.8 **532**

A 9-Speaker Battle Announcing System.—H. W. Duffield. (*Communications*, Oct. 1945, Vol. 25, No. 10, pp. 48–50.) "The system's frequency response rises from about 250 to 500 cycles and then is reasonably flat at 6 000 cycles at which point it decreases. It is capable of creating a sound level of about 116 db above the reference level of 0.000 204 dyne per square cm, at a distance of 30ft from the loud speakers. The major part of the energy is radiated through a cone of 50°." Diagrams of the amplifier (output 250 W) are given, and the loudspeakers are described.

621.395.623.8 **533**

Modulated-Air Super Speaker.—(*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 426..430.) Air at 20 to 25 pounds/sq inch pressure is pumped through an electro-mechanical modulator to the horn. The modulator comprises thirty-four 0.006 inch slits, the apertures of which are controlled by the currents in the speech coil. Acoustic power output 15 to 20 W.

621.395.625.2 + 534.43 **534**

Improving Recordings.—N. C. Pickering. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 82..214.) "How to get the most out of phonograph recordings." Eccentricity of the centre hole of a record of as little as .008 inch may cause objectionable variations in pitch, and non-uniform speed produces distortion ("wow"). High-frequency response which does not accentuate some harmonics and attenuate others is desirable, and harmonic distortion should be avoided. Methods of volume expansion are described.

621.395.625.2 + 534.43 **535**

Crystal [gramophone] **Pickup Compensation Circuits.**—B. B. Bauer. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 128–132.) "From consideration of recording practice, record properties, pickup frequency characteristics, and listener acceptance, the appropriate corrective network for connecting crystal pickup to amplifier input to give desired overall frequency response is determined."

621.395.625.2/.3 **536**

Some Aspects of Sound Recording.—V. M. Brooker. (*Proc. Instn Radio Engrs, Aust.*, Sept. 1945, Vol. 6, No. 3, pp. 3–7. Discussion, pp. 7–9.) Magnetic recordings are made on tungsten steel tape 0.08 mm thick and 3 mm wide moving at 5 ft/s; alternatively carbon steel (0.5 or 0.8% C) wire of about 0.003 inch diameter is used. A wiping head magnetizes the wire to saturation and the recording head applies local variations in the magnetization which follow the a.f. signal. Background noise is dependent on the quality and uniformity of the tape, and can be improved by superposing an h.f. component of about 30 kc/s on the a.f. current to the recording head. Disks of ethyl cellulose, operated at a constant groove speed, are used in embossing systems of recording; the weight of the recording head is critical. Scratch and rumble noises, the ionization treatment of wax masters, and sapphire cutting tools are discussed.

621.395.625.2 **537**

Recorder on Tape has Voice Control.—J. M. Lee. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 167..189.) The Hartron, formerly the Recordgraph, records at 60 ft/min on embossed grooves on a 50-foot film belt: there are 115 parallel grooves. The starting and stopping is voice-controlled. Immediate playback to a p.a. system or to the modulator of a radio transmitter is possible. The equipment is easily portable and was used for battle recording.

621.395.625.3 **538**

Magnetophon Tape Recording Equipment.—(*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 234..238.) Account of an observer's report on a German device. Tissue-thin tape made of plastic impregnated with iron oxide is used for magnetic recording. The recordings have a frequency range of 50–8 000 c/s with some response at 12 000 c/s. The tape can be cut and spliced with ease.

621.395.625.3 **539**

Postwar Recorders Show New Ideas.—I. Queen. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 176, 185.) Recorders for home and office use will soon appear on the market. A typical instrument is $7\frac{3}{4} \times 4 \times 1\frac{3}{4}$ inches in size, weighs 3 lb, and carries sufficient 0.003 inch diameter steel wire to give $2\frac{1}{4}$ hours recording time.

621.395.641 **540**

Discussion on "Modern Submarine Cable Telephony and the Use of Submerged Repeaters".—R. J. Halsey. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 279–280.) Discussion on 1100 of 1945.

621.395.667 **541**

A True Tone Control.—G. Bertsche. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 97..123.) A simple condenser-resistance network which can be calculated to give any required bass or treble boost and attenuation. The attenuation equation is given.

621.396.62 **542**

[Receiver] Power Output Stages.—King. (*See* 722.)

AERIALS AND TRANSMISSION LINES

621.315.2(091) **543**

From the Single-Strand Overhead Telephone Line to the Modern High-Frequency Cable.—D. (*Bull. schweiz. elektrotech. Ver.*, 14th Nov. 1945, Vol. 36, No. 23, pp. 789–791. In German.) An historical survey of cable technology.

621.315.213.12 : 621.317.3.029.58/.62 **544**

Apparatus for Measurements on Balanced-Pair High-Frequency Cables in the Range 10-200 Mc/s.—Simmonds. (*See* 667.)

621.315.229 **545**

Jacketing Materials for H-F Transmission Lines.—Warner. (*See* 631.)

621.392 **546**

Waves and Wave Guides.—G. G. (*QST*, Dec. 1945, Vol. 29, No. 12, pp. 53..102.) Continuation of 284 of February.

621.392 **547**

The Capacity of Twin Cable.—Craggs & Tranter. (*See* 660.)

621.392.012.2 **548**

New Transmission-Line Diagrams. — A. C. Schwager & P. Y. Wang. (*Trans. Amer. Inst. elect. Engrs*, Sept. 1945, Vol. 64, No. 9, pp. 610–615.) Three new charts are developed from those of Evans and Sels (*Elect. J.* 1922, p. 550). (a) Circle diagram for calculation of the power at one end of a transmission line when the power at the other end is known. This chart is deduced essentially by a conformal transformation between the transmitting plane and the receiving plane. (b) Circle diagram for calculation of the impedance at one end when that at the other is known. This is obtained in a similar way. (c) Universal transmission line chart for determining the essential data pertaining to the line when either the power and voltage at the same end, or the power at one end and the voltage at the other are given.

621.392.21 **549**

Solving Transmission Line Problems.—R. C. Paine. (*Communications*, Oct. 1945, Vol. 25, No. 10, pp. 66..89.) Charts of tanh and coth $(\alpha + j\beta)$ are given, with two numerical examples of their application to line problems.

621.392.21 **550**

The Application of Heaviside's Transposition Rule to the Study of the Rise of Current and Voltage in a Line.—S. Colombo & M. Parodi. (*Rev. gén. Élect.*, Oct. 1945, Vol. 54, No. 10, pp. 309–312.) The application of operational methods, in particular the use of the unit function and the transposed or delayed unit function to the study of the transient regime in uniform lines.

621.392.21 **551**

The Capacitance and Thermal Conductance of Screened Multi-Pair Systems in High-Frequency Cables.—H. R. F. Carsten. (*J. Instn elect. Engrs*, Part I, Nov. 1945, Vol. 92, No. 59, pp. 423–425.) Long abstract of 3323 of 1945.

621.396.67 **552**

Note on Broadcasting Antenna at Trivandrum.—M. K. N. Abraham. (*Electrotechnics*, Sept. 1945, Nos. 17/18, pp. 122–124.) The aerial is a vertical radiator grounded at the base, and power is supplied at a tapping approximately half-way along it. Wavelength 453.9 m, aerial length 0.169λ. See 3681 of 1937 (Morrison & Smith) for basic work.

621.396.67 **553**

Artificial Antenna.—S. Wald. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 150–154.) "Design of a two-terminal lumped-constant network that simulates, within a specified frequency band, the impedance variations of a single-wire antenna." The design is effected in terms of the following parameters :– reactance and resistance at the low frequency limit ; resonant and antiresonant frequencies ; resistance at the resonant frequency ; resistance at some frequency between the upper frequency limit and the resonant frequency ; resistance at the upper frequency limit.

621.396.674 **554**

Receiver Loop Antenna Design Factors.—E. M. Kendell. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 62, 64.) A high Q is necessary, and this must be obtained with the loop in its normal position in the receiver. Test results on solenoid, basket weave, and embossed (Airloop—see 289 of February) types of loops are given.

621.392 + 621.396.67 **555**

Transmission Lines, Antennas and Wave Guides [Book Review].—R. W. P. King, H. R. Mimno, & A. H. Wing. McGraw-Hill, New York, 1945, 347 pp., $3.50. (*Electronics*, Nov. 1945, Vol. 18, No. 11, p. 516.) See 3803 of 1945.

CIRCUITS

621.3.012 **556**

Graphical Analyses of Nonlinear Circuits.—A. Preisman. (*Quart. appl. Math.*, Oct. 1945, Vol. 3, No. 3, pp. 185–197.) The currents in the circuit are determined from the points of intersection of lines representing the linear elements of the circuits with the current/voltage characteristic curve of the non-linear element. In the case of a non-linear resistance in series with an inductance, a finite operator curve involving $L/\Delta t$ (corresponding to Heaviside's L_p) is introduced. Similar methods are available for other reactive circuits, and when applied to a negative resistance in series with an inductance show that this circuit can produce relaxation oscillations.

Application of the method to an ideal balanced amplifier shows that the output and mid-branch currents can only contain odd and even harmonics respectively.

621.314.12 **557**

Crystal-Driven Modulator for D-C Amplifiers.—J. A. Williams. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 128–129.) The d.c. input is passed through a carbon microphone button mechanically joined to a rochelle-salt crystal. The crystal unit is excited by a constant-output 1 kc/s oscillator. The vibrations of the button convert the d.c. input to an a.c. signal which is amplified in a three-stage band-pass amplifier. A continuously variable calibration voltage is provided, and a gain control and step-attenuator in the amplifier allow for a wide range of input levels.

621.314.2 + 621.317.72] : 621.362 **558**

A.C. Amplifier and Voltmeter.—L. C. Roess. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, p. 113.) Abstract, with circuit diagram, of a paper (*Rev. sci. Instrum.*, July 1945) on an instrument for measuring thermocouple outputs down to a limit of 5.10^{-10}V. The radiation to the couple is interrupted at 1–5 c/s, and the amplifier sharply tuned to the interruption frequency.

621.316.722.078.3 : 621.385.18 **559**

Utilizing the VR-Series Tubes [for voltage stabilizers].—Anderson. (*See* 801.)

621.318.32 : 621.318.42 **560**

Ferroinductance as a Variable Electric-Circuit Element.—Ryder. (*See* 643.)

621.318.72/.73].012.3 **561**

Resistance-Capacitance Filter Chart.—E. Frank. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 164–165.) Gives values of *R* and *C* for low-pass and high-pass filters in terms of the rejection desired at any frequency from 10^{-3} to 10^{9} c/s, and gives also the reactance of a capacitor at any such frequency.

621.392.5 : 621.3.015.33 **562**

Pulse Response : A New Approach to A.C. Electric-Network Theory and Measurement.—E. C. Cherry. (*J. Instn elect. Engrs*, Part I, Dec. 1945, Vol. 92, No. 60, pp. 462–464.) Long summary of 3841 of 1945.

621.392.52 **563**

A New Kind of Filter Circuit.—T. S. Skillman. (*Communication Rev.*, 1945, Vol. 1, No. 1, pp. 39–41.) Consideration of filter circuits followed or preceded by a highly back-coupled amplifier, for use in a carrier telephone system. By the use, for example, of one simple resonant circuit, a response to frequencies "flat to within 0.2 db has been achieved over a working range where previously only something like 2 or 3 db could be achieved".

621.392.53 : 621.395.623.7 **564**

Woofer-Tweeter Crossover Network.—Klipsch. (*See* 529.)

621.394/.397].64 **565**

Analysis of Cathode Follower.—C. N. Jeffery. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 434..450.) Long summary of 2922 of 1945.

621.394/.397].645 **566**

Cathode Biased Amplifiers.—P. H. Hunter. (*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, p. 92.) "Analytical methods for determining the operating point when circuit constants and supply voltages are known."

621.394/.397].645.34 **567**

A New Method of Investigating Stability.—A. Leonhard. (*Arch. Elektrotech.*, Jan./Feb. 1944, Vol. 38, Nos. 1/2, pp. 17–28.) A theoretical and mathematical paper on the stability of electrical systems in which there is a back-coupling of energy from the output to the input terminals. It postulates that the ratio of the feed-back voltage to the input voltage can be stated in the form of a polynomial fraction function of p (the disturbance being assumed proportional to e^{pt}). Equating this ratio to unity gives a polynomial function of p. The new method consists of the substitution of $j\omega$ for p in this polynomial and the plotting of the resultant curve $H(j\omega) = 0$ in the complex plane as a function of ω. The stability of the system, and even, in many cases, approximation to the frequency and damping of the damped oscillatory modes, can be deduced from the form of this curve by certain rules which are stated and proved. It is claimed that the process is simpler to apply and wider in scope than those of Hurwitz and Nyquist, to which detailed reference is made. The process is illustrated, and compared with the former methods, by a number of examples. See also 1932 Abstracts p. 279 (Nyquist).

621.396.611.21 **568**

Crystal Oscillator Theory.—(*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 16..25.) Summary and discussion of 3324 of 1945 (Fair).

621.396.615 **569**

Notes on the Stability of LC Oscillators.—N. Lea. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 261–274. Discussion, pp. 275–279.) The stability of 2-terminal and 4-terminal oscillators is considered generally. The frequency instability (due to phase instability) and the temperature coefficient of frequency are minimized by reducing the phase error. The effects of harmonics, inter-electrode capacitances, cathode-heater coupling, photo-electric effect, microphony, and changes during warming up are briefly considered. The use of bridge stabilization and of buffer stages is discussed.

The stability of the L and C elements of the resonator depend on temperature, humidity, and mechanical effects. The performance of the variable-gap capacitance compensator is analysed.

The thermal performance of the Franklin oscillator is analysed approximately, and the results are found to be in fair agreement with measured values of the frequency deviations during warming up.

Three experimental oscillators are described and their measured stabilities given to illustrate features of design and performance discussed earlier.

It is stressed that humidity can have a serious effect, though it usually receives little attention.

621.396.615 **570**

On the Frequency Maintained by a Valve Oscillator.—J. Queffelec. (*C.R. Acad. Sci., Paris*, 5th Feb. 1945, Vol. 220, No. 6, pp. 194–196.) The tuned-anode back-coupled oscillator is treated as a class C amplifier, and the formula $\omega^2/\omega_0^2 = 1 - 1/Q^2(1 + \mu M/L)$ derived for the ratio of the oscillator frequency to the natural frequency of the tuned anode circuit in terms of the amplification factor (μ), the Q-factor and self-inductance of the tuned circuit (Q and L), and the mutual inductance (M) between the anode and grid circuits.

621.396.615.17 : 621.317.755 **571**

A Single Sweep Time Base — Part I.—D. McMullan. (*Electronic Engng*, Jan. 1946, Vol. 18, No. 215, pp. 21–23.) A modified Eccles-Jordan trigger circuit operated by negative pulses. It gives single sweeps with automatic or manual resetting. The time delay is a fraction of one microsecond. A circuit is given for the expansion of any given portion of a recurrent waveform, using an auxiliary time base.

621.396.615.17.029.62. **572**

Frequency Multiplication for the V.H.F. Bands.—Gardner. (*See* 793.)

621.396.621.54.029.6 : 621.396.611.21 **573**

Crystal-Controlled Receivers for A-M, F-M and Television.—S. X. Shore. (*Communications*, Oct. 1945, Vol. 25, No. 10, pp. 70..110.) A discussion of design features for crystal oscillators suitable for use in f.m. receivers and for the sound channel of television receivers. In the case of television receivers required to cover several channels, a bridge circuit with a number of crystals in parallel is proposed. For previous parts see 3826 of 1945 and 170 of January.

621.396.622 : 621.396.619.018.41 **574**

F-M Ratio Detectors.—R. G. Peters : S. W. Seeley. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 42..84.) Analysis of a detector system described by Seeley in an I.R.E. paper (reference not given), by which it is possible to build an f.m. receiver without a limiter. For another account see *Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 82..164.

621.396.622.6 : 546.28 **575**

Silicon Crystals for UHF Detection Circuits.—Cornelius. (*See* 771.)

621.396/.397].645.31 **576**

Some Considerations in the Design of Wide-Band Radio-Frequency Amplifiers.—J. E. Cope. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 237–246.) Theoretical and practical consideration of sensitivity, bandwidth, amplitude linearity, gain control, electrical stability, and paralysis. Particular reference is made to television amplifiers for 45 Mc/s with a bandwidth of 4 Mc/s. The design of the input circuit for maximum sensitivity gives a noise factor of 6 db. Inter-stage coupling is arranged to give adequate stage gain consistent with bandwidth and phase linearity requirements.

Diode and anode-bend detectors are compared ; the push-pull diode is best. Methods of gain control and their effect on the input capacitance are considered, but no fully satisfactory method exists.

Regeneration is influenced by valve effects, filtering, chassis materials, earthing points, coil screening and decoupling condensers, and means of reducing it are suggested.

Paralysis by impulsive interference can be countered by making the l.f. impedance of the decoupling circuits as small as possible.

621.396.645.31 **577**

Role of the Neutralizing Capacitor in Tuned Power Amplifiers.—W. Pritchett. (*Communications*, Oct. 1945, Vol. 25, No. 10, pp. 52..84.) An analysis giving consideration to the problem of wide-band neutralization, and to factors influencing the design of neutralizing capacitors.

621.396.662.2.076.2 **578**

Permeability Tuning.—W. J. Polydoroff. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 155–157.) A survey of the technique and advantages in typical receiver applications. "Using the same geometrical dimensions of core and coil we may expect an inductance variation in broadcast receivers of the order of 10 to 1, in short-wave receivers of the order of 4 to 1, and less than 2 to 1 in the v.h.f. bands." The problem of moulding a core so as to provide uniform properties along its length, and the use of dust cores in transmitter circuits are briefly considered.

621.396.662.34 : 621.396.611.21 **579**

Specially-Wide-Band Filters Using Cultivated Crystals.—W. Bantle, B. Matthias & P. Scherrer. (*Schweiz. Arch. angew. Wiss. Tech.*, June 1945, Vol. 11, No. 6, pp. 161–164.) By the use of piezo-electric crystals of mono-potassium or mono-ammonium phosphate it is possible to construct band-pass filters having a bandwidth of up to 33% of the mid-frequency, as compared with 13% for similar constructions using quartz. Also, the auxiliary inductances required are smaller than for quartz. This is due to the more favourable ratio of the effective series capacitance to the effective shunt capacitance in the equivalent electric circuit of such crystals. The use of various combinations of the two kinds of cultivated crystal also has possibilities outside the range covered by quartz alone.

621.396.665 **580**

Volume Expander Design.—R. W. Ehrlich. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 124–127.) An electronic expander in which the gain of a push-pull amplifier is controlled by a separate amplifier and rectifier. Full expansion is obtained in about ten milliseconds with a return to normal gain in one second. Control of the amount of expansion and of the time constant makes the unit applicable to practically all classes of programme material.

621.3.015.3 **581**

Simple Calculation of Electrical Transients [Book Review].—G. W. Carter. University Press, Cambridge, 120 pp., 8s. 6d. Macmillan, New York, $1.75. (*Elect. Engng, N.Y.*, Nov. 1945, Vol. 64, No. 11, p. 422.) ". . . an elementary treatment of transient problems by Heaviside's operational method in linear electrical circuits with lumped constants." See also 742 and 2830 of 1945.

621.392 : 621.3.015.33 **582**

Pulsed Linear Networks [Book Review].—E. Frank. McGraw-Hill, New York, 267 pp., $3.00. (*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 30, 68. Also *Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 222, 224.) ". . . for a first course in transient phenomena for college students." ". . . covers its field extremely well."

621.394./397].645.34 **583**

Network Analysis and Feedback Amplifier Design [Book Review].—H. W. Bode. D. Van Nostrand, New York, 1945, 551 pp., $7.50. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 508..510.) " Basic circuit theory and mathematical analysis of feedback amplifiers is presented in generalized form for the design engineer . . . The discussion is interspersed with practical circuit considerations and conclusions."

621.396.662.3 **584**

Einführung in die Theorie der Rundfunk-Siebschaltungen [Book Review].—R. Feldtkeller. S. Hirzel, Leipzig, 1940, 168 pp., RM 12. (*Akust. Z.*, July 1940, Vol. 5, No. 4, pp. 231–232.) " . . . an excellent text " for university students.

GENERAL PHYSICS

537.226 : 621.315.616 **585**

Synthetic Rubbers and Plastics — X. Electrical Properties : Theoretical Considerations in Relation to the Dipole Theory.—E. D. Humphries & A. W. Stannett. (*Distrib. Elect.*, Jan. 1946, Vol. 18, No. 161, pp. 71–75.) The variation of dielectric constant and loss factor with frequency and temperature is explained qualitatively in terms of the Debye theory of dispersion, and is illustrated by experimental results on polyvinyl chloride.

537.56 **586**

On the Formation of Small Ions, Large Ions and Neutral Centres.—G. Reboul. (*C.R. Acad. Sci., Paris*, 26th Feb. 1945, Vol. 220, No. 9, pp. 267–268.) A description of a mechanism to account for the observations noted in 3786 of 1945.

538.32 **587**

An Analysis of Electromagnetic Forces.—W. A. Tripp. (*Elect. Engng, N.Y.*, Oct. 1945, Vol. 64, No. 10, pp. 351–356.) The lack of evidence for the attraction between electrons in a cathode-ray beam suggests that the attraction between parallel conductors carrying current in the same direction is not due to attraction between the currents themselves, but to attraction between stationary " unneutralized " protons in one conductor and the moving electrons in the other. This leads to the general propositions that like charges in *relative* parallel motion repel each other, and that unlike charges in *relative* parallel motion attract each other. It is shown that the development of this point of view not only accounts satisfactorily for forces between neighbouring current-carrying conductors, but also for phenomena, such as the " pinch effect " in current-carrying molten metal, that are not explained satisfactorily in terms of the attraction between filaments of current. (But see 1413 of 1945.)

538.56 : 517.512.2 **588**

Fourier Transforms of Retarded and Advanced Potentials.—S. T. Ma. (*Phys. Rev.*, 1st/15th Oct. 1945, Vol. 68, Nos. 7/8, pp. 166–172.) " The Fourier transforms of the retarded and advanced potentials of the electromagnetic field and of the wave fields of elementary particles are obtained with the help of the invariant functions of Jordan, Pauli, and Dirac, together with their generalizations. It is shown that the Fourier transforms of these potentials are closely related to those of the outward and inward moving waves given by Dirac for the scattering problems in quantum mechanics, and their connection is discussed. It is also shown that there exists a type of potentials which represents waves with frequencies of opposite signs propagating in opposite directions."

538.561.029.6 **589**

The Production of Extremely Short Electromagnetic Waves.—J. P. Cooley & J. H. Rohrbaugh. (*Phys. Rev.*, 1st/15th May 1945, Vol. 67, Nos. 9/10, pp. 296–297.) " By using as electric dipole radiators many small, aluminum particles in a rapid, continuously flowing stream of oil, radiation measured to be between approximately 2.2 mm and 0.2 mm was produced. The necessary electric field was supplied by a shock excitation circuit generating 1 000 surges per second, which were applied to a 1 cm gap containing the oil-stream." Spectra produced by wire diffraction gratings were examined with thermopiles. The apparatus is briefly described.

535.22 **590**

The Velocity of Light [Book Review].—N. E. Dorsey. Trans. Amer. Phil. Soc., New Series, Vol. 34, Part 1, 1944, 110 pp., $2.50. (*Science*, 2nd Nov. 1945, Vol. 102, No. 2653, pp. 458–459.) A critical review of the experimental data. The author " has set a standard of rigorous and objective criticism . . ."

621.396.61 **591**

Théorie des Oscillateurs [Book Review].—Y. Rocard. Editions de la Revue Scientifique, Paris, 1941, 220 pp. (*Proc. phys. Soc.*, 1st Nov. 1945, Vol. 57, No. 324, pp. 587–588.) " On the whole a book which the physicist with a taste for elementary mathematics would do well to buy."

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

061.6 : 550.38 **592**

Summary of the Year's Work, to June 30, 1945, Department of Terrestrial Magnetism, Carnegie Institution of Washington.—J. A. Fleming. (*Terr. Magn. atmos. Elect.*, Dec. 1945, Vol. 50, No. 4, pp. 279–286.)

523.165 **593**

The Geophysical Aspect of Cosmic Rays [Twenty-ninth Guthrie Lecture].—A. Duperier. (*Proc. phys. Soc.*, 1st Nov. 1945, Vol. 57, No. 324, pp. 464–477.) The results of a number of workers investigating the correlation of cosmic ray intensity and temperature of the earth or atmosphere, are discussed. Measurements of the diurnal variation of cosmic radiation can be accounted for by assuming a magnetic field at the surface of the sun sufficient to prevent particles of less than 2.10^9eV from reaching the earth. A marked 24 hour and a 12 hour periodicity has been observed. The most notable feature of the effect of magnetic storms is a decrease in cosmic ray intensity of world-wide nature.

523.746 + 550.38 **594**

Solar and Magnetic Data, July to September, 1945, Mount Wilson Observatory.—(*Terr. Magn. atmos, Elect.*, Dec. 1945, Vol. 50, No. 4, p. 313.)

523.746 **595**

Provisional Sunspot-Numbers for July to September, 1945.—W. Brunner. (*Terr. Magn. atmos. Elect.*, Dec. 1945, Vol. 50, No. 4, p. 319.)

550.38 **596**

A Preliminary Study of the Relation Between Geomagnetism and the Circulatory Motions of the Air in the Atmosphere.—O. R. Wulf. (*Terr. Magn. atmos. Elect.*, Dec. 1945, Vol. 50, No. 4, pp. 259–278.)

551.51.053.5 **597**

Scattering of Radio Waves from Great Virtual Distances.—L. Harang. (*Terr. Magn. atmos. Elect.*, Dec. 1945, Vol. 50, No. 4, pp. 287–296.) "Using a pulse-transmitter of high power, scattered reflections corresponding to virtual reflection-distances of 500 to 2 500 km have been obtained.

"The test-frequencies used (10–11 Mc/sec) were usually greater than the critical penetration-frequencies of the F_2-layer. Records on a fixed frequency over a number of days have been taken in order to study the diurnal variation and dependence on geomagnetic activity and aurora. Four different phases in the diurnal variation have been recorded. During the two day-phases it has been shown that the scattered reflections cannot come in vertically as they are not cut off by the *F*-layer.

"During the two night-phases the echoes are reflected from scattering areas lying in or near the zenith at heights of 500 to 800 km. Small geomagnetic disturbances increased the scattering at these heights. Stronger perturbations were accompanied by scattering from heights down to 100 to 200 km."

551.51.053.5 **598**

Note on Diffusion in the Ionosphere.—J. C. Jaeger. (*Proc. phys. Soc.*, 1st Nov. 1945, Vol. 57, No. 324, pp. 519–523.) The general equations of diffusion, recombination and ion production set up by Hulbert (*Phys. Rev.*, 1928, Vol. 31, p. 1018.) are quite insoluble. An exact solution is given for the special case of an atmosphere in which the particle density varies exponentially with height, and in which the effects of recombination and the earth's magnetic field are neglected. Numerical results are given for three special initial distributions of ion density.

551.51.053.5 : 523.78 **599**

Radio-Echo Observations at Tromsö During the Solar Eclipse on July 9, 1945.—L. Harang. (*Terr. Magn. atmos. Elect.*, Dec. 1945, Vol. 50, No. 4, pp. 307–310.) "The critical frequencies of the ionized layers were determined during the partial eclipse at Tromsö. The maximum obscuration was 92 per cent. For the F_1- and E_1-layers a symmetrical decrease and increase of the critical frequencies and the corresponding maximum electron-densities were observed during the eclipse. For the F_1-layer the maximum electron-concentration decreased from 3.47 to 1.48×10^5 electrons/cm^3, that is, by 57 per cent. For the *E*-layer the maximum electron-concentration decreased from 2.04 to 1.04×10^5 electrons/cm^3, that is, by 49 per cent. For the F_2-layer the commencement of the eclipse was followed by a sudden decrease in the ionization-curve, the latter having a minimum at about the time of maximum obscuration. But after the eclipse the previous conditions of the F_2-layer seem not to have been restored. From the observations it seems to be evident that the eclipse has an effect on the F_2-layer but that this effect is masked by vertical movements and the slower recombination-processes."

621.316.93 **600**

Lightning Investigations on 33-Kv Wood-Pole Lines.—Andrews & McCann. (*See* 760.)

621.396.91 : 551.509 **601**

[E layer] **"Controls" the Weather.**—(*Sci. News Lett., Wash.*, 17th Nov. 1945, Vol. 48, No. 20, p. 310.) Solar radiation appears to be connected both with the weather and with the thickness of the *E* layer of the ionosphere. *E*-layer measurements may therefore assist forecasting of temperature peaks and troughs a week ahead. Article duplicated in *Science*, 16th Nov. 1945, Vol. 102, No. 2655, Supplement p. 12.

LOCATION AND AIDS TO NAVIGATION

621.3(41) "1939/1945" **602**

British Electrical Engineers and the Second World War.—Dunsheath. (*See* 729.)

621.38 : 538.74 : 629.13 **603**

Flux Valve Aero Compass.—R. Lewis. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 93..126.) To overcome frequent manual resetting of the azimuth scale of an airborne gyro-compass, resetting is continuously performed by the amplified signals from a flux valve through a selsyn motor. The three horizontal "star" coils of the flux valve superimpose the pick-up from the earth's magnetic field on a 400 c/s exciting field.

621.396 : 629.13 **604**

Aviation Communication Systems.—D. W. Rentzel. (*Elect. Engng, N.Y.*, Nov. 1945, Vol. 64, No. 11, pp. 387–391.) An account of the progress that has been made in two-way communication, basic methods of navigation, and blind landing systems. The present and future frequency allocations over both long and short distances for these requirements are given. The problems of collision warning indicators, radio altimeters, air traffic control, and written communication to aircraft, which remain to be solved before air travel is safe and reliable, are closely analysed. The basic problems of voltage supply and weight and size of airborne equipment are discussed.

621.396.9 **605**

The Loran System – Part I.—D.G.F. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 94–99.) Description of the principles of "hyperbolic" navigation systems with particular reference to Loran. The system comprises two pairs of synchronized pulse transmitters operating on the same radio frequency within the band 1.7 to 2.0 Mc/s, each pair of transmitters having its own characteristic and accurately controlled pulse repetition frequency. At the receiving station (on board the craft which desires to fix its position) arrangements are made to measure the difference in the times of arrival of pulse-trains from the respective transmitters in each pair. By utilizing signals reflected from the *E* layer as well as ground-wave signals, and by suitably disposing the transmitters, useful ranges of up to 750 miles by day and 1 500 miles by night are obtained. Mention is made of the SS Loran system in which synchronization of the pulse repetition frequencies at the slave transmitters remote from the "double master station" is achieved by using the signals received at the "slaves" from the "master" *via* the *E* layer. For Part II see 606 below. See also 3916 of 1945 for an account of a similar system (Gee).

621.396.9 **606**

Loran Receiver-Indicator.—D.G.F. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 110–115.) Exact coincidence, to an accuracy of 1 μs, of the 40 μs pulses from the master and slave stations is accomplished by two expansions of the portion of the horizontal sweep upon which the pulses appear. By substituting a time scale for the pulses on each trace, the time difference is measured in units, tens, hundreds, and thousands of microseconds. Circuit diagrams and photographs of the presentation are given. The complete process can be carried out in less than one minute, and can be repeated for a second pair of stations working on the same r.f., but with a slightly different pulse repetition rate. For part I see 605 above.

621.396.9 **607**

New Aid to Navigation.—(*Electrician*, 30th Nov. 1945, Vol. 135, No. 3522, pp. 592–593.) A brief account of the Decca navigator system. See also 331 of February.

621.396.9 **608**

The SCR-584 Radar – Part I.—D.G.F. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 104–109.) Detailed description of an equipment used to control anti-aircraft fire, capable of tracking aircraft automatically at a range of 18 nautical miles and of detecting them at a range of 40 nautical miles. The wavelength used is between 10 and 11 cm, and a pulse length of 0.8 μs enables the target range to be indicated to an accuracy of ±25 yds, repeatable to ±2 yds. Helical scanning at 6 rpm is used for searching, and conical scanning at 1400 rpm for tracking, the angular accuracy of follow then being 0.06°. The equipment is normally trailer-mounted, and the 6ft-diameter paraboloid reflector used with the aerial can be retracted for transportation. For part II of this article see 609 below.

621.396.9 **609**

The SCR-584 Radar – Part II.—D.G.F. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 104–109.) The antenna feed system consists of coaxial transmission lines, the inner conductor supported by quarter-wave stubs. The rotating joints have quarter-wave overlaps between inner and outer conductors with a small gap forming a capacitance path for the r.f. energy while allowing free rotation of the joint about the line axis. To enable the same antenna to be used for the transmitter and for the receiver, a low pressure gas discharge tube (TR cell) is inserted in the feed to the receiver. This tube has two conical electrodes forming part of a resonant cavity which can be tuned to the transmitter frequency. When the cavity is excited by the strong transmitted pulse a high potential appears across the electrodes, sufficient to break down the gap and short-circuit and de-tune the cavity. The transmitter pulse is thus made harmless to the receiver. After the end of the transmitted pulse the gap de-ionizes in about 1 μs and the weaker echo signals are coupled through the TR cavity to a silicon crystal mixer, with a reflex klystron as the local oscillator. The 30 Mc/s i.f. signal passes to two preamplifier stages mounted adjacent to the crystal, then to the i.f. stages in the receiver proper where, after the fifth stage, the i.f. channel divides into two. The servo channel, operating through a narrow gate, feeds the auto-tracking circuits, and the range channel feeds the indicators. For Part I see 608 above.

621.396.9 **610**

Fire-Control Radar MPG-1.—H. A. Straus, L. J. Rueger, C. A. Wert, S. J. Reisman, M. Taylor, R. J. Davis & J. H. Taylor. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 92–97.) A 3 cm wavelength radar unit, housed in a water-tight trailer van, to give tracking of small fast targets with sufficient resolution and accuracy for use in directing the fire of heavy calibre coastal defence batteries, and capable of being operated within a few hours of the selection of a site. A 35 kW pulse, 1 μs wide for the PPI (searching), and 1/4 μs for the tracking B-scope, is obtained from a magnetron oscillator. The r.f. energy is fed to the antenna system through four waveguide arms in the rotating feed assembly. For PPI, one of the feed arms is fixed in the centre of the antenna throat and energy is radiated along the antenna axis. For the B-scope, the feed assembly rotates at 4 revolutions per second across the antenna throat, causing the beam to sweep 16 times per second across a 10° sector centred on the antenna axis, which is itself adjustable between 0°–360° with either presentation. The receiver system contains a duplexer with TR and anti-TR switch valves, to enable the same antenna to be used for transmitter and receiver, a klystron local oscillator with automatic frequency control to compensate for drift of transmitter frequency, a 30 Mc/s i.f. amplifier with 10 Mc/s bandwidth, and a video output amplifier feeding the oscilloscopes. A 163.88 kc/s crystal oscillator is used for the synchronization system and to derive the range markers. Maximum accuracy when tracking, 20 yds and 0.5° azimuth, at a maximum range of 28 000 yds. Searching range 80 000 yds with reduced accuracy.

621.396.9 **611**

Radar in A.A. Defence.—H. G. Foster. (*Electronic Engng*, Jan. 1946, Vol. 18, No. 215, pp. 2–8.) A description of a G.L. Mk. II radar set giving slant range, elevation and azimuth. Operating frequency between 55 and 85 Mc/s. The receiver uses separate aerials and cathode-ray tubes for range, elevation, and bearing; aerials and display are switched by a synchronous motor to a single receiver channel. Outputs from two bearing aerials are opposed, and the resultant alternately added to and subtracted from the range-aerial output, giving two equal pips on the screen when on target. Elevation is determined by comparing the outputs, with a goniometer, from two dipoles λ and $3\lambda/2$ above the ground. Range 2 000–14 000 yds, accuracy ± 25 yds, bearing and elevation accuracy ± 1°.

A Command Post is described, and tactics used in engaging aircraft are described in relation to the limitations of Mk. II equipment.

A brief description is given of G.L. Mk. III, using centrimetric aerial systems in paraboloid reflectors. Range 36 000 yds, accuracy ± 25 yds, bearing and elevation accuracy ± 10′.

621.396.9 **612**

Radar Specifications.—D. G. F. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 116–119.) Specifications of radar equipment require details of the type of pulse, of the radiator, and of the scanning mechanism. Maximum range of detection is determined from pulse and radiator specifications as indicated by the radar equation, which is given (see also 2879 of 1945). Angular accuracy is determined by the radiator specification, and range accuracy by the pulse specification.

The considerations which determine the type and rate of scanning are discussed, and the different types of presentation are listed. A table is given of the specifications of U.S. Signal Corps radar sets working on frequencies from 110 to 10 000 Mc/s, numbered SCR-268, 270, 516, 545, 547, 582/682, 584/784 and AN/TPS-3, AN/TPL-1, AN/MPG-1.

621.396.9 **613**

Shipborne Radar.—G. E. M. Bertram. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 52–56.) A general description, with illustrations, of an SO (Raytheon) radar. Pulse input 250 kW, 1 μs pulses at 400 c/s repetition; receiver uses PPI display. Expected maximum range of commercial model 15–20 miles on ship targets, 4–6 miles for *e.g.* bell-buoys. For another account see *Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 98..130.

621.396.9 **614**

U.S. Carrier Radar.—E. A. Witten. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 162, 196.) A general description of the radio communications and radar equipment on U.S.S. Lake Champlain.

621.396.9 **615**

The Evolution of Radar.—(*Engineering, Lond.*, 24th Aug.–12th Oct. 1945, Vol. 160, Nos. 4154–4161, pp. 154..285.) An eight-part historical account of the main war-time applications.

621.396.9 **616**

Radar Indicators.—E. E. Skinner. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 95..133.) Descriptions of c.r. tube displays used in radar, including the plan position indicator and sector scanning in detail.

621.396.9 : 534.321.9 **617**

Acoustic Control in the Flight of Bats.—D. W. Ewer: H. Hartridge: M. Wilkinson. (*Nature, Lond.*, 8th Dec. 1945, Vol. 156, No. 3971, pp. 692–693.) Correspondence following 258 of February (Hartridge).

621.396.9 : 551.515.43 **618**

Records of Storms with Radar Equipment.—(*Science*, 26th Oct. 1945, Vol. 102, No. 2652, Supplement p.14.) A brief report of the use of microwave radar for the location of storms. The waves are reflected by the rain associated with the storms.

621.396.9 : 623.26 **619**

Mine Detector.—H. Chireix. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 128..194.) The change in self-inductance of a search-coil caused by the proximity of metal alters the phase relation between two voltages applied to a special bridge circuit. This change actuates a relay which in turn operates visual and aural indicators. Summary of U.S. patent 2 376 659.

621.396.932/.933].25 **620**

Radio Marker Buoy.—(*Electrician*, 11th Jan. 1946, Vol. 136, No. 3528, p. 108.) Brief details of the "jelly fish" radio responder buoy.

621.396.932/.933].25 **621**

"Racon" May Guide Ships Safely Through Dense Fog.—(*Sci. News Lett., Wash.*, 24th Nov. 1945, Vol. 48, No. 21, p. 327.) A radar transmitter on the ship interrogates an electronic beacon on shore, which responds automatically. The coded response identifies the beacon; the range and direction given by the radar determine the relative position. Brief note only. See also 620.

621.396.933.23 **622**

Ground-Controlled Approach for Aircraft.—C. W. Watson. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 112–115.) Two ground-based radars are used to assist aircraft in landing in conditions of poor visibility. The search radar with a plan-position indicator guides the aircraft from a range of 30 miles into a position ready for a landing glide. This radar, working at a super-high frequency uses a stacked dipole array with a parabolic reflector giving a beam 6° wide in azimuth. The landing-glide is controlled by the use of a higher-frequency higher-precision radar with a range of 10 miles. This has two beams given by separate aerial systems. The azimuth beam is 1.5° high and 0.6° wide and sweeps a volume 1.5° high and 20° wide; the elevation beam is 3° wide and 0.4° high and sweeps a volume 3° wide and 7° high. The position of the aircraft relative to a correct approach is relayed to the aircraft.

623.454.25 : 621.396.9 **623**

Proximity Fuze.—F. R. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 110–111.) An oscillator feeds an aerial, which may be the missile itself or a small dipole. Energy reradiated from the target is picked up on the aerial and changes its impedance, this change being used to detonate the projectile Power supply is obtained from a battery, supplied with acid through the acceleration produced during projection, or from a small wind-driven generator in the nose of the projectile. For an equivalent explanation of the mechanism in terms of Doppler effect see 89 of January and 625 below.

623.454.25 : 621.396.9 **624**

Generator-Powered Proximity Fuze.—R. D. Huntoon & B. J. Miller. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 98–103.) A detailed description of mechanism and design features. Developed for use with rocket projectiles, the fuse contains a c.w. oscillator tightly coupled to the antenna, which is the rocket itself. Reflections received from the target in varying phase relative to the oscillator effectively cause a cyclic fluctuation of aerial input impedance, so causing the oscillator to beat. This is equivalent to beats between the oscillator and the received signal assuming Doppler effect (*c.f.* 89 of January and 625 below). The beat falls in frequency and rises in amplitude as the rocket approaches its minimum distance from the target. The detonation occurs when the frequency and amplitude of the beat are within prescribed limits. The beat-frequency signal is selected and passed to an amplifier with regenerative feedback at the triggering frequency, high degenerative feedback at higher frequencies, and no feedback at lower frequencies. The amplifier characteristic and aerial directivity give a sharply defined detonation region. When the amplifier output reaches a critical value it fires a thyratron which triggers the explosion. A wind vane in the nose of the rocket drives a generator which, with a voltage regulator and selenium bridge rectifier, provides the h.t. and bias supplies. Raw a.c. is used for the filaments.

623.454.25 : 621.396.9 **625**

The Radio Proximity Fuze.—R. G. Peters. (*Communications*, Oct. 1945, Vol. 25, No. 10, pp. 45..94.) Description of the operation of the fuses in terms of the Doppler principle and also in terms of the principle of changing aerial impedance.

623.454.25 : 621.396.9 **626**

The Proximity Fuse.—(*Radio News*, Dec. 1945, Vol. 34, No. 6, pp. 51..157.) **Radio Fuze Fires Shells.**—(*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 160..201.) **Navy Proximity Fuse.**—(*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 104..136.) General descriptions.

629.13 : 621.396.9 **627**

VHF for Safe Landing.—(*Sci. News Lett., Wash.*, 1st Sept. 1945, Vol. 48, No. 9, pp. 131–132.) Description of some of the work of the Civil Aeronautics Administration in U.S.A. on the development of aids to air navigation with particular reference to use of v.h.f. radio apparatus for blind approach and landing. No technical details are given.

629.13 : 621.396.9 **628**

Funknavigation in der Luftfahrt [Book Review].—P. von Handel & K. Krüger. Friedr. Vieweg & Sohn, Brunswick, 1944, 108 pp., RM 4.50. (*Z. Ver. dtsch. Ing.*, 5th Aug. 1944, Vol. 88, Nos. 31/32, pp. 431–432.) " A comprehensive and exhaustive account of the principles and practice . . . "

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788.7 **629**

Manometer Circuit.—C. J. Calbick. (*Electronic Industr.*, Oct. 1945, Vol 4, No. 10, p. 198.) Alternating voltages are used to prevent errors due to leakage between anode and grid of ionization gauges. The leakage current, being a.c., is not recorded on the d.c. meters. Summary of U.S. patent 2 375 280.

533.56 **630**

High-Vacuum Pumping.—(*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 77..142.) Eimac HV–1 oil diffusion pump gives an ultimate vacuum of 4.10^{-7} mm of mercury, if every possible source of contamination is removed from the high vacuum system and a special oil of low vapour pressure is used. Maximum speed 33 or 72 L/sec at 10^{-5} mm according to whether a baffle is or is not used. Neoprene is recommended in place of rubber for gasket material.

621.315.229 **631**

Jacketing Materials for H-F Transmission Lines.—A. J. Warner. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 38–40, 87.) Suitable materials must (1) flex at – 40°C, (2) withstand 80°C for long periods and 120°C for short periods without deformation, (3) prevent cable deterioration on immersion in fresh or salt water, (4) withstand petrol, hot lubricating oils and hydraulic brake fluids, (5) have toughness and abrasion resistance, (6) not corrode copper, (7) have no adverse effect on the primary dielectric. Long life and good flame resistance are desirable properties.

Most materials used are deficient in some of these properties. Polyvinyl chloride and polyvinyl chloracetate are now most used. Improved plasticizers which do not contaminate the primary dielectric are described.

621.315.612 + 621.315.616 **632**

Radio Insulating Materials: Part 3.—A. H. Postle. (*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 42..70.) The principal electrical and mechanical differences between plastics and ceramics are explained by simple structure theory. Ceramics are classified by their thermal behaviour and chemical nature.

621.315.612.4 **633**

High Permittivity Crystalline Aggregates.—W. Jackson & W. Reddish. (*Nature, Lond.*, 15th Dec. 1945, Vol. 156, No. 3972, p. 717.) Wul's results (347 of February) are characteristic of a range of materials. A graph shows the temperature of peak permittivity for $BaTiO_3$-$SrTiO_3$ solid solutions of various compositions. Peak permittivities of the order of 10 000 have been observed.

621.315.613.1 : [621.317.372 + 621.317.333 **634**

Judging Mica Quality Electrically.—K. G. Coutlee. (*Trans. Amer. Inst. elect. Engrs*, Vol. 64, No. 11, pp. 735–740.) To overcome the uncertainties of the visual quality-classification of natural ruby mica, methods have been devised to test the two electrical properties required for capacitors, namely dielectric loss and dielectric strength. For the former a *Q*-meter is used, comprising a circuit resonant at 1 Mc/s which incorporates test electrodes between which the sample is inserted. The change in capacitance on insertion is corrected by a vernier capacitor which gives a direct classification, on a suitably calibrated meter, according to the *Q* of the specimen. A high-voltage spark test set is used to locate semi-conducting areas, pinholes and cracks. An account is included of tests on finished capacitors made with mica so classified. The tests are found to be satisfactory for testing block mica in accordance with ASTM specification D-748-45T.

621.315.613.1 : 621.319.4 **635**

Manufacture of Silvered Mica Capacitors.—Chapman. (*See* 755.)

621.315.615 : 621.319.4 : 621.365.5 **636**

Capacitors for High-Frequency Induction-Heating Circuits.—F. M. Clark & M. E. Scoville. (*Trans. Amer. Inst. elect. Engrs*, Vol. 64, No. 11, pp. 791–796.) A description of the development of a new type of organic liquid " Lectronol " dielectric for use in water-cooled, hermetically sealed capacitors, suitable for tank circuits of electronic induction heaters. A comparison of the properties of this dielectric with other commercial dielectric liquids shows superiority in capacity per unit volume and instability under severe conditions.

621.315.616 : 537.226 **637**

Synthetic Rubbers and Plastics – X. Electrical Properties: Theoretical Considerations in Relation to the Dipole Theory.—Humphries & Stannett. (*See* 585.)

621.315.616.9 **638**

Discussion on "The Development of Polythene as a High-Frequency Dielectric."—W. Jackson & J. S. A. Forsyth. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 295–297.) Discussion on 2768 of 1945.

621.315.616.9 **639**

Structure and Orientation in Thin Films of Polythene.—A. Charlesby. (*Proc. phys. Soc.*, 1st Nov. 1945, Vol. 57, No. 324, pp. 496–509.)

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621.315.616.9 **640**

Effect of Temperature on the Structure of Highly Polymerized Hydrocarbons.—A. Charlesby. (*Proc. phys. Soc.*, 1st Nov. 1945, Vol. 57, No. 324, pp. 510–518.) The structure of polyethylene over a range of temperature from that of liquid oxygen to above the melting point, has been examined in the electron diffraction camera. As the temperature is raised there is a tendency to form a pseudo-hexagonal structure, but a change from crystalline to an amorphous form sets in at a temperature lower than the accepted melting point.

621.315.617.3 **641**

Insulation Materials.—(*Electrician*, 14th Dec. 1945, Vol. 135, No. 3524, p. 672.) Report of I.E.E. Radio Section discussion on "Film-Forming Materials used in Insulation" led by C. R. Pye. For another account see 352 of February.

621.318.22 + 621.318.322 **642**

Magnetic Materials.—L. Bragg. (*J. Instn elect. Engrs*, Part I, Dec. 1945, Vol. 92, No. 60, pp. 444–451.) An account of the development of magnetic theory is given, leading up to the modern conception of electrons as elementary magnets, in which ferromagnetism arises from unbalanced electron shells. Magnetization proceeds in three stages :– (1) domain boundary displacement (reversible) ; (2) sudden change-over of domains into the "easy" direction of magnetization nearest that of the applied field ; (3) slow change from easy direction to that of the field.

Fundamental atomic properties which cannot be changed are saturation, remanence, and Curie point ; initial permeability, coercivity, and hysteresis loss can be improved considerably by use of modern alloys and appropriate heat treatment. For transformer sheet steel, suitable rolling and annealing assists correct crystal alignment for small hysteresis loss.

621.318.32 : 621.318.42 **643**

Ferroinductance as a Variable Electric-Circuit Element.—J. D. Ryder. (*Trans. Amer. Inst. elect. Engrs*, Oct. 1945, Vol. 64, No. 10, pp. 671–678.) An expression involving the gudermannian is claimed to be superior to previous mathematical expressions for the *B-H* curve for a ferro-magnetic. The expression $B = B_n \, gd \, \frac{aNi}{l} + \frac{cNi}{l}$, where B_n, a, and c are constants, when adjusted to fit the *B-H* curve of a ferromagnetic at three points, gives reasonable agreement with experiment at all values. The expression is used to compute the inductance, effective resistance, reactance, and resonance of ferroinductances, and the results are compared with experiment. The expression indicates maximum permeability when $B = 0$, and is consequently in error at low values of B.

621.318.322.029.5 **644**

Radio Frequency Cores of High Permeability.—H. Beller & G. O. Altmann. (*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 86..154.) The cores are designed for coils required to have a high magnetic flux as well as a reasonably low loss. A special grade of carbonyl iron powder is used and cores with permeabilities of 40 to 70 can be produced. The permeability increases with packing factor of the particles and depends also on the manner of packing. The properties of three toroidal coils made from the new material are investigated.

621.318.322.029.54/.64 **645**

The Permeability of Ferromagnetic Materials at Frequencies between 10^5 and 10^{10} c/s.—J. T. Allanson. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 247–255.) A survey of theories and of methods of measurement and results. Indirect measurements by the following methods are described : (1) transmission line, (2) resonant circuit, (3) impedance bridge, (4) thermojunction, (5) wire grating. Factors bearing on the results, such as the strength of h.f. and d.c. fields, chemical composition, size and temperature of the specimen are discussed. Explanatory theories for the decrease of permeability with increase of frequency are described, and that of Becker (1719 of 1939), depending on eddy-current braking of domain changes is considered a satisfactory explanation of observed results.

621.318.323.2 : 621.396.662.2 **646**

Effective Permeability of High Frequency Iron Cores.—W. J. Polydoroff & A. J. Klapperich. (*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 38..71.) The effective permeability of the cores and the Q of the inductors made with them depend on basic magnetic properties and physical dimensions. True permeability was measured at 1 kc/s by the toroidal ring method, and the effective permeability of cylindrical slugs was measured by observing the difference in inductance of coils with and without the slugs in place. Curves are given showing effective permeability with core-length = coil-length *versus* true permeability for length/diameter ratios from 0.2 to 8.0. An empirical formula connects these effective values with effective values for different coil lengths.

621.357 : 621.38 **647**

Electro-Chemical Processes in the Manufacture of Electronic Devices.—A. Korbelak. (*Beama J.*, Dec. 1945, Vol. 52, No. 102, pp. 424–428.) Abridgement of a paper presented to the Electro-Chemical Society, New York. The deposition of 17 different metals, the electrostatic deposition of various non-metals, electrolytic cleaning, and electro-polishing are discussed.

621.357.9 **648**

Improvement in the Electrolytic Polishing of Aluminium and its Alloys.—P.-A. Jacquet. (*Génie civ.*, 1st June 1944, Vol. 121, No. 11, p. 92.) Short abstract of a paper in *Métaux, Corrosion, Usure*, Nov. 1943. The process can be applied to surfaces up to about 100 cm² in area with voltages of 25–50V, and is applicable to very pure aluminium, and to the most important alloys with copper and magnesium. The compositions of the electrolytes and conditions of working are given in the original paper.

621.385.832 **649**

"Characteristics of Luminescent Materials for Cathode-Ray Tubes."—(*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 299–300.) I.E.E. Radio Section discussion led by C. G. A. Hill, dealing with the emission spectra, phosphorescence, efficiency, secondary emission, mechanical properties and stability of materials as determined by their physical and chemical properties and by the conditions of operation.

621.396.69 **650**

One Facet of Naval Electrical Research.—E. F. Seaman. (*Elect. Engng, N.Y.*, Oct. 1945, Vol. 64, No. 10, pp. 358–362.) "That concerned with the adaptation of shipboard equipment to wartime conditions." Items include fungus, jewel vibration, mica, magnet wire, and various tests.

621.791.352 : 621.385 **651**

Brazing Operations in Transmitter Tube Assembly.—(*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 340–364.) Contains, *inter alia*, a description of a ceramic-lined burner so arranged that the electrode assembly is untouched by the flame during processing.

679.5 + 621.315.616.9 **652**

Notes on Plastics.—J. Taylor. (*Electrician*, 30th Nov. 1945, Vol. 135, No. 3522, pp. 595–596.) Properties and uses of methyl methacrylate and polythene.

679.5 **653**

Plastic Materials.—J. Taylor. (*Electrician*, 14th Dec. 1945, Vol. 135, No. 3524, pp. 675–676.) Properties and uses of polectron (a polymer of vinyl carbazole), polyvinyl alcohol, polyamide moulding materials, and nylon.

533.5 + 531.788 **654**

High Vacuum Technique [Book Review].—J. Yarwood. Chapman & Hall, London, 2nd edn. 1945, 140 pp., 12s. 6d. (*Electrician*, 30th Nov. 1945, Vol. 135, No. 3522, p. 617.) "The author . . . has included many new sections, but generally preserves the previous condensed treatment." See also 3996 of 1945.

MATHEMATICS

512.942 **655**

Vector Analysis.—H. G. Shea. (*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 94–97.) "Review of vector mathematics including divergence and curl for engineers dealing with wave guides and radiation."

517.512.2 : 518.5 : 621.383 **656**

A Photo-Electric Fourier Transformer.—M. Born, R. Fürth & R. W. Pringle. (*Nature, Lond.*, 22nd Dec. 1945, Vol. 156, No. 3973, pp. 756–757.) Note on an instrument for producing a graph of $g'(y) = \int_a^b f(x)\cos(yx + \delta)dx$ on the screen of a c.r. tube from a mask cut out of black paper in the shape of the graph of $f(x)$ or from a photographic record of the function in density variation.

517.512.2 : 538.56 **657**

Fourier Transforms of Retarded and Advanced Potentials.—Ma. (*See* 588.)

518.61 **658**

Calculation of the Magnetic Field in Dynamo-Electric Machines by Southwell's Relaxation Method.—H. Motz & W. D. Worthy. (*J. Instn elect. Engrs*, Part II, Dec. 1945, Vol. 92, No. 30, pp. 522–528.) An explanation and example of the numerical solution of Laplace's equation with assigned boundary conditions, using the relaxation method.

519.283 **659**

Statistical Methods in Quality Control I-VI.—A.I.E.E. Sub-committee on Educational Activities. (*See* 805).

621.392 **660**

The Capacity of Twin Cable.—J. W. Craggs & C. J. Tranter. (*Quart. appl. Math.*, Oct. 1945, Vol. 3, No. 3, pp. 268–272.) A solution of Laplace's equation for the case of two long parallel cylindrical conductors, each surrounded by a coaxial sheath of dielectric, the boundaries of the two dielectric cylinders touching.

A conformal transformation and Fourier's integral theorem are applied to the result, and a quantity is derived by means of a determinant, whence the capacity per unit length can be obtained. Methods of computation are discussed.

621.396.11 : 551.51.053.5 **661**

On the Propagation of Radio Waves.—Rydbeck. (*See* 709.)—Tables of useful cylinder functions of order $\pm 1/3$ and $\pm 2/3$ are given with interval 0.02 from $x = 0$ to 1, and interval 0.2 from $x = 0$ to 8.

51 : 5 + 51 : 6 **662**

Die Mathematik des Naturforschers und Ingenieurs – Vols. 3 & 4 [Book Review].—B. Baule. S. Hirzel, Leipzig, Vol. 3, 80 pp., RM 4.40, Vol. 4, 112 pp., RM 5. (*Z. Ver. dtsch. Ing.*, 8th July 1944, Vol. 88, Nos. 27/28, p. 380.) Analytical geometry, and ordinary differential equations. Part I noted in 4091 of 1945.

518.3 **663**

Alignment Charts: Construction and Use [Book Review].—M. Kraitchik. D. Van Nostrand, New York, 94 pp., $2.50. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, p. 199.) ". . . the basic theory of nomograms is built round determinants."

MEASUREMENTS AND TEST GEAR

531.765 : 621.317.755 **664**

The Exact Measurement of Short Time Intervals on a Cathode-Ray Tube.—W. Amrein & A. von Wattenwyl. (*Schweiz. Arch. angew. Wiss. Tech.*, Sept. 1945, Vol. 11, No. 9, pp. 257–262. In German.) A circular time-base of accurately known frequency is generated from crystal or tuning-fork-controlled circuits. The impulses, between which the time interval is to be measured, are applied to give brightness modulation of the trace, and the angular interval between the starting points of the bright streaks on the screen, measured on a photograph, give a measure of the time. To prevent the trace of the second impulse from overlapping that of the first on a later sweep of the time-base, the first impulse is made to trigger a saw-tooth discharge circuit, coupled to the post-accelerator of the tube so as to change slightly the diameter of the time-base circle for the second impulse. In an example quoted, an interval of 2 ms between impulses was measured to 2 μs. The time-base frequency was 10 kc/s, so that 20 sweeps were made between the starting points of the two traces, and a displacement of 7° corresponded to 2μs interval.

There are errors due to ellipticity and phase irregularities of the time-base. It is relatively easy to keep the first sufficiently small. An error of 2–3° in location of the deflector plates is common in most c.r. tubes, and there can also be phase errors due to stray capacitances, etc., in the phase-shift circuit for producing the time-base, and due to harmonics of the deflecting voltages. Errors due to the last two causes can be minimized by the choice of circuit values, by the use of high-Q circuits, and by taking care not to overload the amplifiers. The accuracy of the time-base can be checked by measuring the angular displacement between the bright traces caused by brightness modulation at a frequency which is an exact multiple of the time-base frequency. A total residual error of the order of 3–4° can be expected in the position of the trace, its relative importance depends on the number of sweeps of the time-base during the interval to be measured.

534.62 **665**

A Method for Obtaining Small Mechanical Vibrations of Known Amplitude.—Smith. (*See* 522.)

621.315.212 : 621.317.341.029.58/.62 **666**

The S-Function Method of Measuring Attenuation of Coaxial Radio-Frequency Cable.—C. Stewart, Jr. (*Trans. Amer. Inst. elect. Engrs*, Sept. 1945, Vol. 64, No. 9, pp. 616–619.) The Q-factor and input reactance of a short-circuited length of cable are measured on a commercial Q-meter. The S-factor, which is a function of the characteristic impedance (assumed to be known) and the measured input reactance of the short-circuited sample, is taken from a graph. The attenuation constant of the cable is S/Qd db/100 ft, where d is the length of the sample in feet. The accuracy of the result is not critically dependent on the accuracy of the value assumed for the characteristic impedance. The usefulness of the method is limited to the range 1-100 Mc/s.

621.315.213.12 : 621.317.3.029.58/.62 **667**

Apparatus for Measurements on Balanced-Pair High-Frequency Cables in the Range 10–200 Mc/s.—J. C. Simmonds. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 282–286.) The apparatus described earlier (3322 of 1945) for use up to 10 Mc/s is extended to 200 Mc/s by replacing the variable capacitor by a short-circuited transmission line of variable length, and the diode resistor by a thermistor. The transmission line reactance is taken as $Z_0 \tan(\omega l/v)$ with $v = 3.10^{10}$ cm/sec. Measurements at 200 Mc/s showed that for a thermistor whose d.c. resistance is less than 10 000 Ω the difference between the h.f. and d.c. values is not greater than ±3%.

The measurement of reactance, resistance, or impedance is made by substitution; characteristic impedance, attenuation, and phase velocity are also readily determined, and typical measurements on a balanced cable are given. Measurements on ½ W solid-carbon-type resistors are shown graphically, and are in close agreement with Howe's theory.

The accuracy of the apparatus is estimated at ±3% for reactance and ±2% for resistance if the thermistor resistance is not too high. The error in phase velocity measurement should not exceed ±1%.

621.315.613.1 : [621.317.372 + 621.317.333 **668**

Judging Mica Quality Electrically.—Coutlee. (*See* 634.)

621.317.331 : 621.3.015.33 **669**

Resistance Measurement at High Impulse Voltages.—S. L. Shive. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 158–159.) A condenser is discharged through the primary of a suitable step-up transformer, and the damped train so produced is applied across a Wheatstone bridge composed of resistors with zero voltage coefficient. Two cathode-ray tubes are used as null-point indicator and voltmeter respectively. It is found that composition-type resistors have a negative voltage coefficient of resistance: the importance of this property in the design of suppressor circuits for ignition systems is considered.

621.317.335 **670**

Capacitance Measurement in Multi-Electrode Systems.—W. Pritchett. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 66–68.) A parallel substitution method developed for measuring neutralizing and other small value capacitors, which is most useful in the range 1–100 μμF.

621.317.372 : 621.317.755 **671**

Cathode-Ray Q Meter.—R. Feldt. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 462..470.) The component under test is excited by means of short pulses synchronized with the sweep frequency. The resulting damped oscillations are taken to the vertical deflection plates, or associated amplifier. The Q, or the decrement of the circuit, may be measured directly by means of a suitably engraved transparent scale fitted to the screen. Reprinted from *DuMont Oscillographer*, Mar./Apr. 1945.

621.317.715.025 **672**

A-C Galvanometer.—A. L. Quirk & H. D. Hall. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 147–149.) An amplifier used in conjunction with a variable self-biased 6E5 electron-ray valve provides a null-point indicator for a.c. bridges that is electrically and mechanically strong, free from vibration troubles, and insensitive to stray fields. The minimum signal that can be detected is 20 μV.

621.317.72 + 621.314.2] : 621.362 **673**

A.C. Amplifier and Voltmeter.—L. C. Roess. (*See* 558.)

621.317.72 : 621.385 : 541.132.3 **674**

pH Meter.—C. Dorsman. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 194..198.) A circuit for the measurement of a small d.c. voltage across a source of high internal impedance. The difference between this voltage and a known adjustable voltage is converted into a.c. and, on amplification, is applied to a cathode-ray indicator. Summary of U.S. patent 2 372 062.

621.317.72.084 **675**

Notes on Zero-Suppressed A.C. Voltmeters.—L. Medina. (*Proc. Instn Radio Engrs, Aust.*, Sept. 1945, Vol. 6, No. 3, pp. 11–16.) Limited demand causes mechanical means of zero suppression, which involve special tooling, to be uneconomic in Australia. Of a number of electrical zero-suppressing circuits investigated and described the best, used for an a.c. voltmeter, has a parallel resonant circuit in series with the instrument. A 20Ω 100 mA moving-iron instrument is connected in series with a resistance of $480\ \Omega$ and with a capacitor of $1\ \mu$F. The capacitor is in parallel with an iron-cored reactor so that the combination is in resonance when 220 V are applied to the whole circuit. Increase of voltage causes a disproportionately great increase of current through the instrument due to change of inductance with current. The scale is nearly linear over the range 220 to 260 V, which occupies more than half the full length of the scale. The circuit is only suitable for a fixed frequency, and is subject to wave-form error.

621.317.73.029.54/.58 **676**

A Radio-Frequency Capacitance and Conductance Bridge.—R. F. Proctor & E. G. James. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 287–290.) A bridged-T network suitable for measurement of partial capacitances and conductances, which operates at 1 Mc/s but can be used up to 50 Mc/s if the usual precautions for residuals are taken. The design, construction, and theory of the bridge are given, and the method of calibrating for conductance is described. Capacitances of 0–28 $\mu\mu$F and conductances of 0–11 μmho can be measured with balancing accuracies of 0.02 $\mu\mu$F and 0.05 μmho respectively. A correction to the capacitance reading, which is a function of the measured conductance, is required.

621.317.73.029.62 **677**

Bridge Method of Measurement at Ultra High Frequencies.—S. Datta. (*Electrotechnics*, Sept. 1945, Nos. 17/18, pp. 85–95.) A modified form of Schering bridge is used at frequencies up to 45 Mc/s for the measurement of capacitance and power factor. The corrections to be applied for residual inductance of the resistors are considerable.

621.317.735 **678**

Industrial [insulation] **Testing with High Voltage.** —(*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 106–108.) Equipment for testing insulation in aircraft. Portable model operates off 110 V 60 c/s, and tests 10–10 000 $M\Omega$ at any voltage between 2 000–15 000 V d.c. Other models test at voltages up to 200 000 V d.c.

621.317.761.029.62/.64 **679**

The Measurement of Frequencies in the Range 100 Mc/s to 10 000 Mc/s.—L. Essen & A. C. Gordon-Smith. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 291–295.) Description of a small portable apparatus for frequency measurement by the interpolation method. A quartz oscillator provides a standard frequency of 1 Mc/s and controls multivibrators at 100 kc/s and 10 kc/s. Two oscillating detectors with respective ranges of 300–600 Mc/s and 15–20 Mc/s enable the unknown frequency to be suitably divided by the observation of audible beats and compared with the standard frequency. The accuracy is estimated at ± 1 part in 10^6 if the measurement is made rapidly to reduce the effect of drift of the detector oscillators.

621.317.784 : 621.385 **680**

Electronic Wattmeter.—L. R. Malling. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 133–135.) In early designs of electronic wattmeters, voltages corresponding to the voltage and current supplied to the load were fed to the wattmeter through transformers. In later models the frequency range has been increased by the substitution of cathode followers for the transformers. The circuit includes push-pull pentode rectifiers that should be well balanced against each other and have accurately parabolic characteristics. Input power is indicated on a d.c. meter with a linear scale.

621.395.61[/.62] : 621.317.39 **681**

Curve-Tracer for Acoustic Devices.—Hellmann. (*See* 527.)

621.396.611.21 **682**

Crystal Oscillator Theory.—(*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 16..25.) Summary and discussion of 3324 of 1945 (Fair).

621.396.611.21 **683**

Practical Problems of [piezoelectric] **Crystal Dimensioning.** — C. W. Franklin. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 96..158.) A finished crystal has one dimension which is thought of as governing its frequency. Changes in other dimensions may however alter the frequency. The frequency and amplitude of vibration are affected by wetness, unequal pressure, or if the air-gap resonates and damps the vibration. Graphs show variations of frequency with different conditions.

621.396.611.21 **684**

Shear Modes in Piezo-Electric Crystals.—S. Bhagavantam & D. Suryanarayana. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, p. 202.) Reprint of 1875 of 1945.

621.396.611.21 : 549.514.1 **685**

Aging of Quartz Crystals.—S. X. Shore. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 70..77.) The surface of a crystal prepared by abrasion is stressed and slowly breaks down; consequently the frequency of the crystal increases with age. This process can be hastened by artificial ageing by a series of heat cycles. Ageing can be avoided by using etching instead of abrasion for the final process of manufacture. For an 8 Mc/s crystal, preparation by abrasion was stopped when the frequency was 10 kc/s below the required value, and final adjustment was made by etching in ammonium bifluoride solution. Part 4 of a series, for previous parts see 3826 of 1945, 170 of January, and 573 above.

621.396.615 **686**

Notes on the Stability of LC Oscillators.—Lea. (*See* 569.)

621.396.67 **687**

Artificial Antenna.—Wald. (*See* 553.)

621.396.933.083.7 : 629.13 **688**

Plane-to-Ground Radio Telemetering.—Moore. (*See* 701.)

621.317.715 + 621.317.75 **689**

Galvanómetros y Oscilógrafos [Book Review].—S. Gerszonowicz. G. E. Stechert (distributor), New York, 1943, 392 pp., $6.00. (*Beama J.*, Dec. 1945, Vol. 52, No. 102, p. 419.) "... a very real contribution to the technical literature on galvanometers."

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

518.5 : 621.383 **690**

A Photo-Electric Fourier Transformer.—Born, Fürth & Pringle. (*See* 656.)

541.132.3 : 621.317.72 : 621.385 **691**
pH Meter.—C. Dorsman. (*See* 674.)

551.509 : 621.396.91 **692**
[E layer] **" Controls " the Weather.**—(*See* 601.)

551.515.43 : 621.396.9 **693**
Records of Storms with Radar Equipment.—(*See* 618.)

621.317.39 : 539.37 : 621.395.645.33 **694**
Strain Analyzing and Recording Instruments.—C. M. Hathaway. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 74..190.) The operation of inductance-type and resistance-type strain gauges is described, as well as bridge circuits, amplifiers, and recording oscillographs used with them. Inductance-type gauges can be used without amplifiers. For resistance-type gauges, amplifiers are required to cover from 0 to about 1 500 c/s.

621.365.5 **695**
Crucible Failure in the Induction Melting Process.—A. Gemant & J. Sticher. (*J. appl. Phys.*, Nov. 1945, Vol. 16, No. 11, pp. 661–667.) Zirconia crucibles occasionally melt locally owing to overheating although the melting point is far in excess of that of most alloys commonly used. A theory is developed which shows that the overheating is more probable the steeper the electrical resistivity/temperature characteristic of the zirconia. The fault may be due to impurities.

621.365.5 : 621.315.615 : 621.319.4 **696**
Capacitors for High-Frequency Induction-Heating Circuits.—Clark & Scoville. (*See* 636.)

621.365.5 : 621.785.6 : 669.14 **697**
Superficial Hardening [of steel] **by Medium-Frequency Induction Heating.**—Seulen & Voss. (*Génie civ.*, 15th June 1944, Vol. 121, No. 12, p. 100.) Short abstract of a paper in *Stahl und Eisen*, 23rd & 30th Dec. 1943. Frequencies of 600 c/s to 2 Mc/s are used according to the thickness required for the hardened layer.

621.365.92 **698**
[Dielectric] **Heating by High-Frequency Currents.**—G. Génin. (*Rev. gén. Élect.*, Oct. 1945, Vol. 54, No. 10, pp. 291–297.) Particular reference to the application to rubber vulcanization processes, and to the economics of the method in general (cost of generator, and of the energy used). A simple analysis of the limiting factors leads to the conclusion that the process is applicable to materials of which the " loss factors " (product of power factor and permittivity) range between 0.005 and 0.01. The article is essentially a survey, with a bibliography of 19 references.

621.369.2 **699**
The Drying of Varnished or Humid Surfaces by Radiation : Descriptions of Infra-Red Installations.—B. Haznadaroff. (*Rev. gén. Élect.*, Oct. 1945, Vol. 54, No. 10, pp. 298–302.) In addition to detailed descriptions of equipment and applications, the paper contains a qualitative theoretical discussion leading to the conclusion, verified by a simple experiment, that an irradiated varnished metal surface may reach a higher temperature than a similar unvarnished surface.

623.26 : 621.396.9 **700**
Non-Metallic Mine Detector.—T. E. Stewart. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 100–103.) A description of equipment type AN/PRS-1, and its method of adjustment and use in the detection of both metallic and non-metallic mines located a few inches below the surface of the ground. It comprises a 300 Mc/s oscillator carried at the end of a suitable exploring handle : a horizontal dipole is coupled to the oscillator and a reflecting dipole is mounted above the first. Alterations in the oscillator grid current are arranged to vary the amplitude of an a.f. note heard in the operator's headphones. The batteries and a.f. apparatus are carried on the operator's back. In operation it is arranged that the resonant frequency of the dipole is lower than that of the oscillator. The ground is explored with the antenna a few inches above the surface. Non-metallic mines increase the resonant frequency of the antenna, thus decreasing grid current and increasing the intensity of the audible note, while metallic mines produce an increase of grid current and a decrease in the audible indication.

621.396.933.083.7 : 629.13 **701**
Plane-to-Ground Radio Telemetering.—D. W. Moore, Jr. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 125–127.) In flight testing of aircraft or in the control of aircraft flight by radio means it is necessary to reproduce on the ground the readings of the various aircraft instruments. This has been done by attaching to the pointer of each instrument a small permanent magnet that controls the phase of a 500 c/s note. The note is transmitted to ground over a radio link, together with a 250 c/s note which serves as a reference for phase. The two signals received on the ground are used to actuate an instrument similar to the primary instrument in the aircraft.

622.19 : 621.395.645.33 **702**
Geophysical Prospecting Equipment.—D. Sheffet. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 116–123.) A field seismograph may consist of groups of twenty-four or more seismometers connected by multi-conductor cables to a control and test panel in the recording van. The outputs of the groups are fed to a number of identical amplifiers connected to a multiple recording oscillograph. The input signals to the amplifiers may vary by 10 000 to 1 ; to reduce this to an average of 2 to 1 at the oscillograph either automatic volume control or pre-adjusted time-rate expansion, to vary the gain with time, is employed. Filters are used to restrict the frequency range of the amplifiers, which must be identical in amplitude and phase response. Accurate control of the timing circuits is accomplished by the use of a 100 c/s temperature-compensated tuning fork.

623.454.25 : 621.396.9 **703**
The Proximity Fuse.—(*See* 623/626.)

629.13 : 621.389 **704**
Electronic Timer for Aircraft De-Icer.—D. W. Bloser & G. R. Holt. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 152–155.) A thyratron timing circuit is used to control the rate of operation of the de-icing boots. Any one of four rates can be selected to counter the different icing conditions that may occur.

629.13 : 621.396 **705**

Aviation Communication Systems.—Rentzel. (*See* 604.)

621.317.39 **706**

Electrical Measurements of Mechanical Quantities [Elektrische Messung mechanischer Grössen : Book Review].—P. M. Pflier. Springer, Berlin, 2nd edition 1943, reprinted (in German) by J. W. Edwards, Ann Arbor, Mich., U.S.A., 259 pp., $6.50. (*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 220..222.) "The book will prove an excellent reference . . ." See also 1705 of 1945.

621.38 **707**

Electronic Equipment and Accessories [Book Review].—R. C. Walker. George Newnes, London, 1945, 428 pp., 25s., and Chemical Pub. Co., Brooklyn, N.Y., $6.00 (*Proc. Instn Radio Engrs, Aust.*, Oct. 1945, Vol. 6, No. 4, p. 15. Also *Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, p. 225.) See also 3751 of 1945.

621.386 : 6 **708**

Die Photozelle in der Technik [Book Review].—H. Geffcken & H. Richter. J. Schneider, Berlin-Tempelhof, 3rd edn., RM 2. (*Akust. Z.*, Sept. 1940, Vol. 5, No. 5, p. 364.)

PROPAGATION OF WAVES

551.51.053.5 : 621.396.11 **709**

On the Propagation of Radio Waves.—O. E. H. Rydbeck. (*Chalmers tekn. Högsk. Handl.*, 1944, No. 34, 168 pp. In English.) Full paper of which the author's summary was noticed in 1382 of 1945. Tables of useful cylinder functions of order $\pm 1/3$ and $\pm 2/3$ are given with interval 0.02 from $x = 0$ to 1, and interval 0.2 from $x = 0$ to 8.

551.51.053.5 : 621.396.11 **710**

On the Question of Short-Wave Propagation.—O. Burkard. (*Funktech. Mh.*, May 1945, No. 5, pp. 65–66.) A satisfactory theoretical explanation of short-wave long-distance communication has not yet been given. The theory of multiple reflection between the ionosphere and earth is inadequate (*e.g.* there are not multiple annular skip-zones around the transmitter). The theory of gradual bending in the ionosphere is unacceptable because, *e.g.*, very small changes in the intensity of ionization in the refracting layer would produce very large changes in range of the signal, so that, contrary to observation, long-distance communications would be confined to very brief intervals when the refracting conditions give exactly the correct range. The existence of "gliding" waves that follow the lower boundary of the ionosphere is proposed. They are somewhat analagous to Sommerfeld's ground waves. The "conducted" waves proposed by Uller (*Jb. drahtl. Telegr.*, 1917, Vol. 15, p. 123, *Z. ges. Naturwissenschaft*, 1939, Vols. 9/10, p. 353.) are not the same, for the conditions necessary for the existence of "conducted" waves are usually not possible in the upper atmosphere.

Following the work of Joos (2642 of 1939), the part of the "gliding" wave that is in the ionosphere has its wave fronts perpendicular to the base of the ionized layer, the part that is in the unionized air below has its wave fronts trailing behind, and energy is radiated obliquely downwards. Taking account of the earth's curvature, this oblique radiation will reach the earth if the angle between its direction of propagation and the vertical is less than a critical value, which is about 75° for a layer height of 230 km. For 30 Mc/s waves this critical angle is calculated to be given by a density of ionization corresponding to a critical frequency of 7.76 Mc/s, which agrees almost exactly with the value for the critical frequency (7.8 Mc/s) observed for limiting long-distance propagation. Other evidence giving qualitative confirmation of the existence of "gliding" waves is mentioned.

621.3.011.2 + 621.3.011.5].029.62 : 631.437 **711**

The Electrical Properties of Soil at Wavelengths of 5 Metres and 2 Metres.—J. S. McPetrie & J. A. Saxton. (*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 247–255.) "The paper gives the results of a year's observations on the electrical constants of a grass-covered sandy loam site at the National Physical Laboratory. Measurements of the reflection coefficient of the ground for radiation of wavelength 5 m indicated that the dielectric constant varied between 5 and 25, and that the conductivity varied from 0.7×10^8 to 4×10^8 e.s.u. Measurements of the attenuation in soil were also made at wavelengths of 5 m and 2 m, and the results indicated similar values for the electrical constants."

621.396.11 : 631.437 **712**

A Note on the Variation of the Ground Absorption Factor with Distance in India at Medium Wave Broadcasting Frequencies.—S. Ramaswamy. (*Electrotechnics*, Sept. 1945, Nos. 17/18, pp. 104–107.) "Methods for calculating this factor have been given and the actual results for Lahore medium-wave broadcasting station have been worked out."

538.56 + 532.59 + 534] "1687–1943" : 016 **713**

Waves and Wave Action [Book Review].—C. C. Lee, Vicksburg, Miss., U.S.A., revised 1944, 91 pp., $5.00. (*Elect. Engng*, Oct. 1945, Vol. 64, No. 10, p. 382.) Annotated bibliography of about 800 books, periodicals, and society publications appearing from 1687 to Dec. 1943.

RECEPTION

621.396/.397].62 **714**

"Design of Broadcast and Television Receivers for the Post-War Market."—(*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 298–299.) I.E.E. Radio Section discussion, led by L. H. Bedford, of the relation between elaboration of design and the economic and manufacturing problems of radio industry after the war. Reference is made to projection *vs.* direct-viewing, and to the limited contribution of radar technique to television receiver design.

621.396.62 : 519.283 **715**

Sensitivity Limits in Radio Manufacturing.—A. S. Blatterman. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 141–143.) A discussion of the statistical considerations underlying the fixing of acceptance limits for the sensitivity of radio receivers coming off a production line. A selected set of average valves is used to determine whether a rejection is due to valve or circuit deficiency.

621.396.621 **716**

Bicycle Radio with 4 Tubes.—R. B. Essex. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 172..189.) A superheterodyne receiver using battery supplies and miniature valves, mounted on the handlebars.

621.396.621 **717**

Miniature Pocket Receiver Design.—W. J. Brown. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 33–37, 54.) Hearing aid technique is used to obtain a radio receiver $6 \times 2\frac{1}{2} \times 1\frac{3}{16}$ inches in size, including batteries. The earphone leads are also the aerial. The circuit includes an r.f. pentode, a tetrode detector, either anode-bend or grid-leak, an a.f. tetrode and an output tetrode. Daylight outdoor range on a 50 kW broadcasting station is from 20 to 100 miles.

621.396.621.029.62 **718**

Build Your Own V.H.F. FM-AM Receiver.—A. Rattray. (*Radio News*, Dec. 1945, Vol. 34, No. 6, pp. 29..159.) Circuit diagrams and constructional details of a receiver to cover the frequency range 88–108 or 115–140 Mc/s. Acorn valves are used for the r.f. amplifier, oscillator and mixer. Two high-gain i.f. stages at 4.3 Mc/s are followed by a stage operating as a low-gain i.f. amplifier for a.m. reception, and as a limiter for f.m. signals.

621.396.621.52.029.56/.62 **719**

Explorer All-Wave Radio.—B. White. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 96..135.) Design and construction of a regenerative receiver for 4.5 to 665 metres using plug-in coils.

621.396.622 : 621.396.619.018.41 **720**

F-M Ratio Detectors.—Peters. (*See* 574.)

621.396.622 : 621.396.619.018.41 **721**

F.M. Detector.—W. R. Ferris. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, p.194.) The incoming wave is incident on a plane or concave diffraction grating with line spacing about one wavelength. A plurality of probes, or dipoles, are placed in the frequency-sensitive zones of maximum field strength of the resultant diffraction pattern. Summary of U.S. patent 2 367 764.

621.396.623 **722**

[Receiver] **Power Output Stages.**—J. King. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 173..207.) Points considered include impedance matching, bias resistance, cathode bypass condenser, output transformer ratio, effect of speaker coil inductance, and use of push-pull.

621.396.662 **723**

Practical Radio Course : Part 39 [Push-button station selectors].—Ghirardi. (*See* 772.)

621.396.665 **724**

Radio Design Worksheet : No. 42 – Some Notes on Automatic Volume Control : Parallel Resonance.—(*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 51–52.) Application of simple time constant theory to the design of orthodox a.v.c. circuits.

621.396.682 : 621.396.621 **725**

Electrification for the Old Set.—G. A. Chase. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 177–178.) A detailed description of the conversion of a battery operated receiver to a.c. mains operation at 110–120 V.

621.396.828 **726**

Reduction of Heterodyne Interference.—H. W. Belles. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 150–151.) The amplitude and phase modulations of the desired carrier signal that are produced by adjacent channel signals, are separately rectified in balanced rectifier circuits. The rectified outputs are combined in opposition, leaving only the desired signal. Attenuation of strong interfering signals to below audibility has been accomplished without effect on the wanted signal.

621.396.932 **727**

Boat Radio Installations.—H. B. O. Davis. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 94..138.) The factors governing the selection and installation of transmitters and receivers for small craft.

621.396[.397].621 **728**

Radio Receiver Design – Part II [Book Review].—K. R. Sturley. Chapman & Hall, London, 1945, 479 pp., 28s. (*Electronic Engng*, Jan. 1946, Vol. 18, No. 215, p. 30.) See also 414 of February.

STATIONS AND COMMUNICATION SYSTEMS

621.3(41) " 1939/1945 " **729**

British Electrical Engineers and the Second World War.—P. Dunsheath. (*Engineering, Lond.*, 26th Oct., 2nd Nov. & 9th Nov. 1945, Vol. 160, Nos. 4163, 4164 & 4165, pp. 335, 360–361 & 383–384. *Beama J.*, Oct. & Nov. 1945, Vol. 52, Nos. 10 & 11, pp. 332–337 & 374–380.) Further summaries of the I.E.E. presidential address. See 415 of February.

621.396 **730**

Communication Development.—A. H. Mumford. (*Electrician*, 26th Oct. 1945, Vol. 135, No. 3517, pp. 437–438.) Summary of inaugural address of Chairman I.E.E. Radio Section. See also 4046 of 1945.

621.396 : 629.13 **731**

Aviation Communication Systems.—Rentzel. (*See* 604.)

621.396.44 (091) **732**

New Systems of Carrier Current Transmission.—A. Marzin. (*Génie civ.*, 1st July 1944, Vol. 121, No. 13, p. 107.) Short abstract of an historical paper read before the Soc. franç. des Électriciens.

621.396.619.018.41 **733**

New FM Bands.—A. Jay. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 163..216.) Trouble due to skywave transmission was possible on the old 40–50 Mc/s band. Propagation characteristics of the new 88–106 Mc/s band are discussed. Replies to a questionnaire on the new f.m. frequency allocations are given.

621.396.619.018.41 **734**

Frequency Modulation.—K. R. Sturley. (*J. Instn elect. Engrs*, Part I, Dec. 1945, Vol. 92, No. 60, pp. 455–456.) Long summary of 4047 of 1945.

621.396.619.018.41 : 621.396.61.029.62 **735**

Simplified F.M.—Geist. (*See* 788.)

621.396.619.018.41 : 621.396.81 **736**

Range Prediction Chart for F-M Stations.—F. C. Everett. (*Communications*, Nov. 1945, Vol. 25, No. 11, p. 57.) Gives the range from transmitter power, aerial height, distance, and desired field strength at the receiver, for " average " ground constants, based on 98 Mc/s, horizontal polarization.

621.396.619.018.41 : 621.396.81 **737**

Ground Wave Range Calculator for FM.—(*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, p. 109.) A chart linking field strength, transmitter height and distance, based on a frequency of 98 Mc/s and 30 ft receiving antenna. Similar data to that presented in 736 above, but in a different form.

621.396.619.018.41 + 621.397.24].052 **738**

Transmission Networks for Frequency Modulation and Television.—H. S. Osborne. (*Elect. Engng, N.Y.*, Nov. 1945, Vol. 64, No. 11, pp. 392–397.) Present and possible future f.m. requirements in the U.S. using ordinary telephone wires for local circuits and carrier telephone networks for inter-city connexions can be met with existing plant. For short-distance television transmission ordinary telephone pairs with special equipment have been used, and the use of existing or improved coaxial cables for longer distances has been advocated. Experiments at 2, 4 and 12 Mc/s have been started on microwave relay systems, and the possible use of waveguides is considered. The programme of the Bell System Companies to meet these broad-band developments is included.

621.396.619.16 **739**

Pulse Modulation.—C. W. Hansell. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, p. 128.) Odd pulses are delayed and even pulses are advanced relative to the unmodulated pulse-train during the positive half cycle of the modulation, and *vice versa* during the negative half cycle. This allows higher peak power, use of higher frequencies, improved signal-to-noise ratio and a degree of secrecy. Diagrams are given. Summary of U.S. patents 2 379 899 and 2 379 900.

621.396.619.16 **740**

Pulse-Time Modulation.—D. Philips. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 46..86.) A transmitter of about 4 500 Mc/s is modulated with a 4 μs marker pulse and eight 1 μs carrier pulses, forming a frame with a repetition rate of 8 000 c/s. Each carrier pulse provides a channel which conveys intelligence by the movement of the pulse in time relative to the marker pulse. The magnitude of this movement is proportional to the amplitude of the modulation. The receiver contains gating circuits, which are synchronized with the transmitter by the marker pulse, and which separate the carrier pulses into the eight output circuits.

Demonstrations of a Federal Telephone & Radio Corp. 24-channel 40-mile inter-city system, Bell Telephone Lab. military set AN/TRC-6, and RCA military set AN/TRC-5 are described.

621.396.619.16 **741**

PT Modulation for Multiple Transmission.—(*Electronic Industr.*, Vol. 4, No. 11, pp. 90–91.) Account of the Federal Telephone and Radio Corp. system. See also 740 above.

621.396.619.16 **742**

Pulse-Time Modulation.—(*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 161..197.)

621.396.63 : 621.396.619.018.41 **743**

FM Radio Relay.—J. M. Lee. (*Radio News*, Dec. 1945, Vol. 34, No. 6, pp. 54..154.) U.S. Army equipment for linking to a telephone system. Frequency 70–100 Mc/s with a transmitter power of 50 W, or 250 W with an additional amplifier. Phase-shift modulation is used, with deviation up to ± 30 kc/s.

621.396.712 **744**

The CBC H-F Global Transmitting System.—R. D. Cahoon. (*Communications*, Oct. 1945, Vol. 25, No. 10, pp. 60..87.) An account of the station described in 193 of January.

621.396.97(091) **745**

25th Anniversary of Radiobroadcasting.—(*Elect. Engng, N.Y.*, Oct. 1945, Vol. 64, No. 10, pp. 365–366.) " History and events that led to the first scheduled broadcast of November 2nd, 1920, from the first established station, KDKA, Pittsburgh."

621.396.97.029.62 **746**

On the Possibility of an Ultra-Short-Wave First Grade Broadcasting Service in India.—S. P. Chakravarti. (*Electrotechnics*, Sept. 1945, Nos. 17/18, pp. 96–103.) Tropical countries, and India in particular, present special problems, *e.g.* high level of atmospherics and man-made static, large seasonal variation of ground conductivity, comparatively low and dense ionosphere, inadequate funds. It is probable that the highest efficiency would be obtained from about 60 low-power stations operating on a wavelength of 5 metres.

621.39 **747**

Jahrbuch des elektrischen Fernmeldewesens [Book Review].—F. Gladenbeck. Georg Heidecker, Berlin, 1940, 379 pp., RM 22. (*Akust. Z.*, July 1940, Vol. 5, No. 4, p. 233.) An account of the research by the German post office during the year.

621.39(05) **748**

Communication Review.—A quarterly house journal newly published by Communication Engineering Pty. Ltd., Sydney, Australia. The contents of the first number are mainly concerned with carrier-cable telephony and associated equipment.

SUBSIDIARY APPARATUS

531.788.7 **749**

Manometer Circuit.—Calbick. (*See* 629.)

533.56 **750**

High-Vacuum Pumping.—(*See* 630.)

535.312 **751**

Directive Optical Systems.—(*Electronic Engng*, Jan. 1946, Vol. 18, No. 215, pp. 27–28.) The transmission of light beams by internal reflections along Perspex rods, for photo-cell and other applications. The amount of light transmitted is shown for typical cases.

621.3.042.5 **752**

Multiple Magnetic Circuits.—J. F. Manildi. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 160–163.) It is shown how the field in the gap of, say, a measuring instrument may be increased for the same gap configuration and amount of magnetic material by using a number of parallel elements in the magnetic circuit to replace a single series element.

621.314.2 **753**

Design Construction and Testing of Radio Power Transformers.—P. Prabhakar & V. V. L. Rao. (*Electrotechnics*, Sept. 1945, Nos. 17/18, pp. 108–121.) After a brief description of various parts, empirical formulae for determining the core size, wire size, and number of turns, are given. Useful constructional hints and an illustrative example are included.

621.314.5 **754**

The Design of Non-Synchronous Vibrators for Radio Sets and Equipment.—R. N. Dewan. (*Electrotechnics*, Sept. 1945, Nos. 17/18, pp. 125–133.) Their underlying principles are discussed and details are given of a type made by the author because of their scarcity on the market.

621.315.613.1 : 621.319.4 **755**

Manufacture of Silvered Mica Capacitors.—A. T. Chapman. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 146–149.) "Discussion of mica quality factors, and details of new manufacturing techniques developed [at Western Electric Co.] to conserve existing stocks of mica and . . . improve tolerances and quality standards of finished units." Stresses the importance of proper assembly, processing, and moulding, to ensure that even the best quality mica does not yield capacitors having poor stability and high temperature-coefficient.

621.316.722.078.3 : 621.396.682 **756**

Voltage-Regulated Power Supplies.—G. E. Hamilton & T. Maiman. (*Communications*, Nov. 1945, Vol. 25, No. 11, pp. 44..81.) Electronic means of voltage stabilization which are described include cold cathode gas filled (neon) tubes, μ-bridge stabilizers, transconductance bridge stabilizers, and degenerative amplifiers. The first of two papers.

621.316.74 **757**

Tapered-Thickness Bimetal.—W. B. Elmer. (*Trans. Amer. Inst. elect. Engrs*, Sept. 1945, Vol. 64, No. 9, pp. 661–665.) Bimetal strips for use in thermostats are most economical in the tapered-thickness form. Charts giving corrections to standard formulae for uniform strips are included. Formulae for determining the fundamental frequency of vibration of single- and dual-tapered strips are also given.

621.316.74 : 621.396.611.2 **758**

Design of Thermostatic Ovens.—T. S. Skillman. (*Communication Rev.*, 1945, Vol. 1, No. 1, pp. 41–45.) An oven is described, capable of accommodating the tuning circuits of 16 oscillators and of maintaining a temperature constant to within ± 0.15° C.

621.316.74 : 621.396.611.21 **759**

[Quartz] **Crystal Oven Anticipates Temperature Changes.**—(*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 406..414.) ". . . it consists of an inner Bakelite chamber to hold the crystals, an insulating air chamber surrounding the Bakelite one and containing heating coils and a limiting [bimetal] thermostat, and an outside Bakelite cover." It is a small unit with standard 11-pin base, to operate with ambient temperatures −40° C to +70° C and control the internal temperature to 1° C.

621.316.93 **760**

Lightning Investigations on 33-Kv Wood-Pole Lines.—F. E. Andrews & G. D. McCann. (*Trans. Amer. Inst. elect. Engrs*, Vol. 64, No. 11, pp. 768–777.) A study of the lightning performances of various types of line design and lightning protection. The investigation made use of photographic surge-current recorders and surge-crest-ammeter links installed on lines. Detailed data were obtained for wood-pole lines continuously protected by overhead ground wires and by deion protector tubes.

621.317.755.087.5 **761**

A Continuous Film-Recording Camera for Use with Standard Cathode-Ray Oscilloscopes.—A. H. Simons. (*Electronic Engng*, Jan. 1946, Vol. 18, No. 215, pp. 10–12.) A friction-drive camera taking 85 mm film or paper, perforated or unperforated. Film speed continuously variable 12.5–50 in/s, f/4.5 lens, no shutter, 100 ft spools. Two discharge lamps are fitted for making timing marks on each edge of the film.

621.318.323.2 : 621.396.662.2 **762**

Effective Permeability of High Frequency Iron Cores.—Polydoroff & Klapperich. (*See* 646.)

621.318.42 **763**

Optimum Air Gap for Various Magnetic Materials in Cores of Coils Subject to Superposed Direct Current.—V. E. Legg. (*Trans. Amer. Inst. elect. Engrs*, Oct. 1945, Vol. 64, No. 10, pp. 709–712.) The method developed is used to calculate curves from which the design dimensions can be obtained to meet specified requirements of inductance, resistance, and d.c. burden. Special cases, in which other quantities are specified, are considered.

621.318.42.017.31 **764**

Eddy-Current Resistance of Multilayer Coils.—T. H. Long. (*Trans. Amer. Inst. elect. Engrs*, Oct. 1945, Vol. 64, No. 10, pp. 712–718.) Formulae suitable for strip-wound coils with partial magnetic circuits (e.g., in the slots of machines) are extended to apply to coils wound from round wire having no external magnetic circuit, by assuming a fictitious permeability and wire of an equivalent square section, which "seems to give results of usable accuracy".

621.318.423 **765**

The Self-Inductance of a Toroidal Coil Without Iron.—H. B. Dwight. (*Trans. Amer. Inst. elect. Engrs*, Nov. 1945, Vol. 64, No. 11, pp. 805–806.) A method for computing the inductance of a coil with rectangular section and a comparatively thick winding, based on the product of magnetic flux lines and the number of turns linked.

621.319.4.011.4 **766**

Resistance and Capacitance Relations Between Short Cylindrical Conductors.—F. L. ReQua. (*Trans. Amer. Inst. elect. Engrs*, Oct. 1945, Vol. 64, No. 10, pp. 724–730.) Formulae are given for a number of side-by-side dispositions of the conductors, taking account of end effects. These give results in better agreement with experiment than the conventional formulae which assume the length of the conductors great compared with their distance of separation.

621.384.6 **767**

100,000,000-Volt Betatron.—(*Sci. News Lett., Wash.*, 3rd Nov. 1945, Vol. 48, No. 18, pp. 278–279.) Popular account of the device described in 438 of February.

621.385.832 **768**

Application Techniques for Cathode-Ray Tubes.—Christaldi & Lempert. (*See* 775.)

621.386 **769**

Industrial X-Ray Tubes.—Z. J. Atlee. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 136–140.) A survey of properties of X-ray tubes for microradiography and diffraction, at voltages from 50 kV to 2 MV peak. Difficulty has been encountered in providing targets with a wide range of atomic number. The atomic number of the target should be lower than that of the material under examination by diffraction.

621.386 (091) **770**

Roentgen-Ray Tubes.—W. D. Coolidge & E. E. Charlton. (*Gen. elect. Rev.*, Nov. 1945, Vol. 48, No. 11, pp. 36–41, 44–51.) An authoritative review of developments in the past 50 years.

621.396.622.6 : 546.28 **771**

Silicon Crystals for UHF Detection Circuits.—E. C. Cornelius. (*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 74..140.) At frequencies of the order of 1 000 Mc/s and upwards the diode detector is no longer serviceable and has been replaced by a silicon crystal and tungsten "cat's whisker". The combination is assembled in a ceramic cartridge and embedded in wax. The performance is much improved by the inclusion in the silicon of controlled small amounts of other substances. The operating conditions are discussed with the aid of an equivalent circuit diagram.

621.396.662 **772**

Practical Radio Course: Part 39 [Push-button station selectors].—A. A. Ghirardi. (*Radio News*, Dec. 1945, Vol. 34, No. 6, pp. 56..136.) Reviews various selector systems and the special oscillator preselector tracking problems that arise. Considers very fully systems using preset trimmers or tuned circuits with capacitance or inductance tuning.

621.396.662.2 **773**

Winding Universal Coils.—A. W. Simon. (*Electronics*, Nov. 1945, Vol. 18, No. 11, p. 170.) Simple rules for modifying a coil of known self-inductance so as to obtain a desired inductance value. Similar rules are given for locating the tap on a coil and for adjusting the mutual inductance or coupling coefficient between two coils to a required value.

621.396.682 : 621.396.621 **774**

Electrification for the Old Set.—Chase. (*See* 725.)

TELEVISION AND PHOTOTELEGRAPHY

621.385.832 **775**

Application Techniques for Cathode-Ray Tubes.—P. S. Christaldi & I. E. Lempert. (*Proc. Radio Cl. Amer.*, Nov. 1945, Vol. 22, No. 1.) Comprehensive recommendations for the selection of cathode-ray tubes, and for the design of appropriate power supplies, with special reference to the use of makers' specifications.

621.396.619.018.41 + 621.397.24].052 **776**

Transmission Networks for Frequency Modulation and Television.—Osborne. (*See* 738.)

621.396/.397].62 **777**

"Design of Broadcast and Television Receivers for the Post-War Market".—(*See* 714.)

621.397 **778**

Television Developments.—(*Wireless World*, Dec. 1945, Vol. 51, No. 12, pp. 371–372.) A description of the system referred to in 230 of January.

621.397.26(73) "1927–1944" **779**

Television Broadcasting Practice in America – 1927 to 1944.—D. G. Fink. (*J. Instn elect. Engrs*, Part I, Dec. 1945, Vol. 92, No. 60, pp. 457–458.) Long summary of 3955 of 1945.

621.397.3 **780**

"Colour Television".—(*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 258–259.) Report of I.E.E. discussion led by L. C. Jesty embracing point, line, and frame scanning using the minimum requirement of three primary colours, and definition, bandwidth, and colour fringing on moving objects.

621.397.5 **781**

Studio Technique in Television.—D. C. Birkinshaw & D. R. Campbell. (*J. Instn elect. Engrs*, Part I, Dec. 1945, Vol. 92, No. 60, p. 459.) Long summary of 3961 of 1945.

621.397.62 **782**

Functions of Video Circuit.—E. M. Noll. (*Radio News*, Dec. 1945, Vol. 34, No. 6, pp. 48..151.) Explains the need for d.c. restoration on the picture tube to maintain correct average brightness, and describes the necessary video circuits.

621.397.82 **783**

Multipath Interference in Television Transmission.—D. I. Lawson. (*J. Instn elect. Engrs*, Part I, Dec. 1945, Vol. 92, No. 60, pp. 460–461.) Long summary of 3958 of 1945.

621.386 : 6 **784**

Die Photozelle in der Technik [Book Review].—H. Geffcken & H. Richter. J. Schneider, Berlin-Tempelhof, 3rd edn., RM 2. (*Akust. Z.*, Sept. 1940, Vol. 5, No. 5, p. 364.)

621.397.5 **785**

Television Programming and Production [Book Review].—R. Hubbell. Murray Hill Books, New York, 1945, 207 pp., $3.00. (*Elect. Engng*, Oct. 1945, Vol. 64, No. 10, p. 382.) "Provides a foundation for the techniques. . . ."

TRANSMISSION

621.396.61.029.56/.58 **786**

A Four-Band 125-Watt Transmitter.—B. Goodman. (*QST*, Dec. 1945, Vol. 29, No. 12, pp. 22–24.) Oscillator and doubler include 7C5 tetrodes, amplifier 4D32 tetrode; operation is on 3.5, 7, 14, or 28 Mc/s.

621.396.61.029.58 **787**

Engineering Details of OWI 200 Kw Units.—H. Romander. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 100..162.) This fully modulated inverted amplifier operating in the range 6-22 Mc/s occupies a space $22\frac{1}{2}$ ft × 6 ft × $6\frac{1}{2}$ ft and is driven by a 50 kW transmitter. It includes two F-135-A tubes. A motor-driven shorting bar is used to tune a pair of copper pipes which, together with a second pair coupled to the antenna, form the anode circuit. Push-pull circuits are used in the a.f. equipment; satisfactory harmonic suppression and good stability are obtained with three negative feedback loops. The main rectifier has twelve F-857A rectifiers arranged in a three-phase full-wave rectifier circuit with a transformer bank connected in delta-delta.

621.396.61.029.62 : 621.396.619.018.41 **788**

Simplified F.M.—J. C. Geist. (*QST*, Dec. 1945, Vol. 29, No. 12, pp. 29..90.) A $2\frac{1}{2}$ metre a.m. or f.m. transmitter. For a.m. the modulator is connected to the final amplifier. " With the switch in the f m. position the oscillator is [anode] amplitude modulated at a low percentage. Amplitude modulation of the self-excited oscillator also causes frequency modulation. . . . Since the depth of modulation is kept low, the amplitude modulation is wiped out by the succeeding Class-C stages. The frequency modulation remains. . . . The resulting output from the transmitter is a virtually constant-amplitude frequency-modulated carrier."

621.396.61.029.62 : 621.396.645.31.029.62 **789**

300 Watts on 50 and 144 [Mc/s]**.**—E. P. Tilton. (*QST*, Dec. 1495, Vol. 29, No. 12, pp. 25–28.) A frequency-tripler and amplifier for use with the 50 Mc/s a.m.-f.m. transmitter described in 468 of February.

621.396.615 **790**

Notes on the Stability of LC Oscillators.—Lea. (*See* 569.)

621.396.615 **791**

On the Frequency Maintained by a Valve Oscillator.—Queffelec. (*See* 570.)

621.396.615.14 **792**

Some Measurements on Micro-Radio Waves of Wavelengths from 15 to 19 Centimetres.—Das & Chakravarti. (*See* 803.)

621.396.615.17.029.62 **793**

Frequency Multiplication for the V.H.F. Bands.—H. A. Gardner. (*QST*, Dec. 1945, Vol. 29, No. 12, pp. 45..102.) Points considered are the choice of valves, the use of push-pull circuits, frequency checking, and decoupling. Circuits are given for a 50 Mc/s transmitter controlled by a 3.5 Mc/s crystal and a 144 Mc/s transmitter using either a 3.6 or a 7.2 Mc/s crystal.

621.396.645.31 **794**

Role of the Neutralizing Capacitor in Tuned Power Amplifiers.—Pritchett. (*See* 577.)

621.396.932 **795**

Boat Radio Installations.—H. B. O. Davis. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 94..138.) The factors governing the selection and installation of transmitters and receivers for small craft.

VALVES AND THERMIONICS

537.58 **796**

Saturation Currents of Thermionic Emission in Vacuum.—C. Macherey. (*Génie civ.*, 1st/15th Nov. 1944, Vol. 121, Nos. 21/22, pp. 170–172.) Calculation of the effect of space charge on the current between plane electrodes, and an account of the range of application of Richardson's and Child's formulae.

537.583 : 621.385 **797**

Measuring Emission Characteristics with Pulse Technic.—R. L. Sproull. (*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 112–113.) Long summary, with diagrams, of 2642 of 1945.

621.385 **798**

Tube Replacements.—I. Queen. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 100–101.) U.S. valves with identical characteristics but different bases or filament voltages are listed.

621.385 : 621.791.352 **799**

Brazing Operations in Transmitter Tube Assembly.—(*See* 651.)

621.385.16 **800**

Centimeter-Wave Magnetrons.—H. F. Argento. (*QST*, Dec. 1945, Vol. 29, No. 12, pp. 17–21.) The anode of a cavity magnetron consists of a thick-walled copper cylinder with a number of identical key-hole shaped slots opening into the inner face. Precision machining of a solid block has been replaced by building up from punched sheets and brazing, thus expanding production rates ten times. The oxide-coated cathode may give up to 100 A emission current. Peak outputs of up to a 10^6 W on microsecond pulses are obtained at centimetre wavelengths with about 50% efficiency, 30 000 V input, and magnetic fields of 2 000 gauss. Tunable magnetrons and velocity-modulated tubes are briefly described.

621.385.18 : 621.316.722.078.3 **801**

Utilizing the VR-Series Tubes.—W. H. Anderson. (*QST*, Dec. 1945, Vol. 29, No. 12, pp. 36–37.) Basic design data and nomographs are given for voltage regulators using a simple circuit with gas-filled stabilizing tubes.

621.385.8 **802**

Sensitive Gas Relay Tube.—J. Reiss. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 450..458.) Summary of 3302 of 1945.

621.396.615.14 **803**

Some Measurements on Micro-Radio Waves of Wavelengths from 15 to 19 Centimetres.—P. N. Das & S. P. Chakravarti. (*Electrotechnics*, Sept. 1945, Nos. 17/18, pp. 78–84.) A 4036A triode is used to generate Barkhausen oscillations in the range 1 580–2 000 Mc/s and some estimates of the power output are made.

MISCELLANEOUS

519.283 **804**

Statistical Methods in the Development of Apparatus Life Quality.—E. N. Ferrell. (*Elect. Engng*, Oct. 1945, Vol. 64, No. 10, p. 367.) Abstract of a paper before the Amer. Inst. Elect. Engrs.

519.283 **805**

Statistical Methods in Quality Control I–VI.—A.I.E.E. Sub-committee on Educational Activities. (*Elect. Engng, N.Y.*, May/Nov. 1945, Vol. 64, Nos. 5/11, pp. 181..402.) The first six parts of a series dealing, respectively, with I. Variability of quality/frequency distributions; II. Measurement by variables and by attributes; III. Frequency distribution for set-up check of process; IV. Sub-grouping of data, finding causes of trouble; V. Variations to be expected in sampling; VI. Charts for go-and-no-go inspection.

620.193 **806**

Some Practical Instances of the Corrosion of Non-Ferrous Metals in Telecommunications Plant.—W. G. Radley. (*J. sci. Instrum.*, Dec. 1945, Vol. 22, No. 12, pp. 237–238.) Corrosion of cable sheaths and of bunches of wires behind switchboards is mainly due to moisture and leakage currents. Chemical inhibitors have been used with some success.

620.193 **807**

Controlling Factors in Atmospheric and Immersed Corrosion.—W. H. J. Vernon. (*J. sci. Instrum.*, Dec. 1945, Vol. 22, No. 12, pp. 226–230.) The controlling factor in immersed corrosion is usually either cathodic potential, the production of protective films, or the rate of supply of the promoting factor. In atmospheric corrosion it may be the humidity and impurity of the atmosphere, or the physical properties of the initial film. The influence of these factors is reviewed.

620.193.7 **808**

Electrochemical Measurements for Corrosion Studies.—P. T. Gilbert. (*J. sci. Instrum.*, Dec. 1945, Vol. 22, No. 12, pp. 235–237.) The potentials and corrosion currents of four couples were measured and it was found that (*a*) if the corrosion is largely electrochemical the corrosion current is directly related to the amount of corrosion; (*b*) when two metals are corroding in contact an unknown factor is usually introduced; (*c*) local cathodes on the anode and *vice versa* cause an increase in corrosion; (*d*) with a single metal these local elements cause most of the corrosion, but for an electro-positive and an electro-negative couple, they may be of only secondary importance.

621.394/.396].6(213) **809**

Report on the Deterioration of Telecommunications Equipment in Tropical Areas.—R. J. Collins, C. S. Gittoes & D. W. Rowed. (*Proc. Instn Radio Engrs, Aust.*, Oct. 1945, Vol. 6, No. 4, pp. 3–8.) Report on observations made by the Radio Mission of the Instn Radio Engrs, Aust., with the First Australian Army, July–August 1945. Most faults were due to effects of moisture. Normal air day temperature is 90° F, with 90% relative humidity at night and same moisture content by day. Power-driven equipment is usually sheltered in huts or vehicles and heaters can be fitted to lower the relative humidity. Portable equipment may be exposed to weather and even immersed in water. Moisture lowers the insulation resistance, alters dielectrics, increases the value of some resistors, and may lead to fungus growth. Fungus itself apparently did not affect performance. Faults due to electrolytic action of dissimilar metals were not apparent. Waxes and varnishes increase component life but do not stop moisture absorption. Components should be waterproofed, and it is recommended that variable controls, such as rheostats, should have leads sealed, and glands of silicone around the control shaft. Silicone glands and rubber gaskets can be used for sealing equipment cases. Greater use of thermoplastic insulators is advised as the ambient temperature rarely exceeds 90° F. New ceramics are non-porous and do not need surface treatment. Tough rubber or polyvinyl chloride insulated wires are satisfactory. Dry batteries in sealed cans are weather-proof, and failure, except due to age, is rare. Packing cases should be strong, allow ventilation when stacked, and have metal or plastic inner linings which can be resealed.

Portable equipment should fit inconspicuously on operator. For jungle use r.t. sets with an output of 2W and receiver sensitivity of 1μV are suggested. Batteries need only have a life of a few hours. Erection of large aerials is often impossible, and remote erection would be useful.

621.396.69 **810**

One Facet of Naval Electrical Research [Adaptation of equipment to war conditions].—Seaman. (*See* 650.)

621.798 : 621.396.69 **811**

Hermetic Sealing.—G. Herbert. (*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 44–47, 89.) A satisfactory seal must provide a perfect environment for the functional unit and maintain that condition through all external changes. A practical specification includes 5 cycles of temperature change from + 85° C to – 55° C followed by at least 5 cycles in salt water between + 85° C and 0° C, without insulation resistance falling below the minimum limit. The main protective case can follow the lines of canned-food containers, which prevent the troubles associated with moisture, fungus, dirt, and lowered atmospheric pressure. The insertion of insulated terminals presents many difficulties. Gasket technique has many applications but will not hold gas pressures. Ceramics may be metallized and "blended" into metal cases, but glass to metal seals, as in valve technique, offer many attractions.

519.283 **812**

Sampling Statistics and Applications [Book Review].—J. G. Smith & A. J. Duncan. McGraw-Hill, New York and London, 1945, 498 pp., $4.00. (*Elect. Engng, N.Y.*, Nov. 1945, Vol. 64, No. 11, p. 422.) Fundamentals of the theory of statistics.

621.3.029.5/.6 **813**

Fortschritte der Hochfrequenztechnik – Vol. 2 [Book Review].—F. Vilbig & J. Zenneck (Eds.). Akad. Verlagsges. Becker & Erler Komm.-Ges., Leipzig, 1943, 856 pp., RM 56. (*Z. Ver. dtsch. Ing.*, 5th Aug. 1944, Vol. 88, Nos. 31/32, p. 431.) "The book is important and valuable for the high-frequency physicist and technician." Vol. 1 was noted in 577 of 1942.

621.396 **814**

Modern Radio [Book Review].—K. S. Tyler. Harcourt, Brace & Co., New York, 230 pp., $2.50. (*J. Televis. Soc.*, Dec. 1944, Vol. 4, No. 4, p. 88.) ". . . an excellent example of a semi-technical book . . ."

ABSTRACTS AND REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534.213.4 : 621.392 **815**

The Analysis of Plane Discontinuities in [acoustic] **Cylindrical Tubes : Part I.**—J. W. Miles. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 259–271.) Using a transmission line analogy the effect of the discontinuity is calculated by considering the higher modes which are excited. The equations of motion of the propagation of a small disturbance in a cylindrical tube yield the two-dimensional wave equation, the solutions of which constitute an infinite set of modes. The analogy with the electrical transmission line is established, and it is shown that each mode requires a separate transmission line.

534.213.4 : 621.392 **816**

The Analysis of Plane Discontinuities in [acoustic] **Cylindrical Tubes : Part II.**—J. W. Miles. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 272–284.) "The theory of plane discontinuities developed in part I [see 815 above] is applied to a 'window' and change of cross section in tubes of both circular and rectangular cross section. In the case of the rectangular tube conformal mapping is introduced as an alternative approach to the problem. Reflection and transmission coefficients are determined from the equivalent circuit of part I, and the theory is also applied to the analysis of certain types of cavity resonators. Finally, the experimental determination of equivalent circuit impedance is discussed."

534.23 **817**

Acoustic Transmission through a Fluid Lamina.—I. Rudnick. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 245–253.) Based on a derivation of the acoustic wave equation for moving media, the transmission and reflection coefficients are derived for a fluid lamina in uniform motion. Some measurements are reported in the frequency range 2 kc/s to 14 kc/s for angles of incidence of between 0° and 89°.

534.231 + 621.396.11 **818**

The Saddle-Point Method in the Vicinity of a Pole with Applications to Wave-Optics and Acoustics.—Ott. (*See* 1024.)

534.232 + 621.396.677 **819**

Small-Dimensional Radiating and Receiving Systems of High Directivity.—Makov. (*See* 857.)

534.232 **820**

Acoustic Intensity Distribution from a "Piston" Source : II. The Concave Piston.—A. O. Williams, Jr. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 219–227.) It is shown how an approximate expansion may be obtained for the r.m.s. excess pressure in the supersonic beam from either a plane or concave piston source when the wavelength is small and the radius of curvature large compared with the aperture of the source. For part I see 2670 of 1945 (Williams and Labaw).

534.321.9 **821**

New Aspect of Ultrasonics.—B. K. Sahay. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 285–286.) The study of ultrasonics may reveal a corpuscular nature of sound energy.

534.321.9 : 620.179 **822**

The Supersonic Reflectoscope, an Instrument for Inspecting the Interior of Solid Parts by Means of Sound Waves.—F. A. Firestone. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 287–299.) Subsidiary reflections take place from flaws in the metal. The signal received by a piezoelectric crystal is displayed on a c.r. tube.

534.41 + 534.781 **823**

Visible Patterns of Sound.—R. K. Potter. (*Science*, 9th Nov. 1945, Vol. 102, No. 2654, pp. 463–470.) Phase relationships between fundamental and harmonics may render waveform records of sound dissimilar to the eye when the differences are indistinguishable to the ear. In the sound spectrograph the record obtained on a magnetic tape is played back repeatedly into a scanning filter, the passband of which moves across the frequency spectrum. The legibility of the records thus obtained is discussed. Learning to read visible speech is comparable in difficulty with learning to lip read.

534.522.5 **824**

Lissajous Figures.—I. B. Cohen. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 228–230.) A description of the harmonograph used by Professor Sabine to draw some Lissajous' figures.

534.833.1 **825**

Demountable Soundproof Rooms.—W. S. Gorton. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 236–239.) A room having an attenuation of about 43 db is made from panels consisting of two sheets of steel cemented to two sheets of composition board with a rock-wool blanket between. The panels weigh 7 lb/sq. ft. It is easy to construct and dismantle, and its materials can nearly all be re-used.

534.833.4 **826**

The Effect of Position on the Acoustical Absorption by a Patch of Material in a Room.—C. M. Harris. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 242–244.)

621.395.61 **827**

Gradient Microphones.—H. F. Olson. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 192–198.) " The response-frequency and directional characteristics of gradient microphones from zero to *n*th order have been obtained. Higher order unidirectional microphones have also been developed. The directivity increases with the order which means a corresponding discrimination against random sound. The accentuation of the low-frequency response, when the distance from a small source is less than a wave-length, increases with the order and the wave-length. This feature may be used to obtain high discrimination against distant sounds in a close talking microphone. The amount of discrimination increases with the order of the microphone."

621.395.623.52 **828**

Generalized Plane Wave Horn Theory.—V. Salmon. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 199–211.) " By the use of dimensionless variables and simplifying transformations Webster's plane wave horn equation is recast into a form permitting separation of the effects of horn contour and frequency. A generalized expression for the admittance also displays this separation. Further interrelations among the variables are developed which permit the formal synthesis of a horn from a given conductance or susceptance function. The conditions for realizability of the horn thus synthesized are discussed. Several applications of the results are presented, including a comparison with Freehafer's exact theory for the hyperbolic horn."

621.395.623.52 **829**

A New Family of Horns.—V. Salmon. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 212–218.) " A new family of horns is synthesized in which the exponential forms a central member. This permits the effect of perturbations from the exponential contour to be estimated. From other members of the family unique impedance characteristics are obtained, and are discussed with possible applications in mind."

621.395.623.75 **830**

A High Quality Loudspeaker of Small Dimensions.—P. W. Klipsch. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 254–258.) Description of a horn designed to be used with a " woofer " (see 727 of 1942 and 1708 of 1943—Klipsch). 330 c/s l.f. cut-off, no peaks or hollows up to 7 kc/s, satisfactory performance to 12 kc/s. Normal radiation angle $\pi/2$ steradians. Negligible harmonic distortion " even at painfully loud intensities".

621.395.625.2/.6 **831**

Film Sound-Recording Methods.—W. Hahm. (*Funktech. Mh.*, Sept./Oct. 1943, Nos. 9/10, pp. 102–104.) A review of the distinctive features of each of six recording systems, variable area and variable density light recording, the Philips–Miller and Tefiphone systems using mechanically engraved film, the Magnetophone system of magnetic recording on a film loaded with ferromagnetic particles, and the Selophone system in which the movement of a vibrating wire of a string galvanometer is recorded photographically.

621.395.625.2 **832**

B.B.C. Disc Recording : Some Technical Details of the New Equipment.—H. Davies. (*Wireless World*, Jan. 1946, Vol. 52, No. 1, pp. 14–18.) The recorder is fed from a 75 W amplifier, with negative feedback obtained from a winding on the cutter head, " radius compensation " to increase the high-frequency response near the centre of the disk, and an " overload protector " to prevent sudden increases of sound from causing harmonic distortion. The traverse head, which carries an oil-damped balanced armature cutter, has automatic positioning and " limit safety " switches. Friction drive to the turntable through an idler wheel prevents vibration and " wow".

621.395.625.2 : 621.396.662.667 **833**

High Fidelity Bass Compensation for Moving Coil Pick-Ups.—F. M. Haines. (*Electronic Engng*, Feb. 1946, Vol. 18, No. 216, pp. 45–46.) High fidelity in the moving-coil pickup has been hampered by lack of adequate bass compensation. A circuit is described which improves bass compensation by the use of frequency-selective negative feedback. Optimum resistance and impedance values for good response over the whole frequency range are discussed.

621.395.625.3 **834**

German Tape-Recording Equipment.—(*Electronic Engng*, Feb. 1946, Vol. 18, No. 216, p. 54.) Another brief account of the " Magnetophon " taken from 538 of March. This system was described in 1028 of 1939 (Lübeck) and back references.

621.395.625.3 **835**

Multiple Wire Recording.—R. J. Tinkham. (*Communications*, Dec. 1945, Vol. 25, No. 12, p. 99.) The master record provides the signal from which a number of recording heads in parallel are operated.

621.395.625.3 **836**

High Quality Sound Recording on Magnetic Wire. L. C. Holmes. (*Communications*, Dec. 1945, Vol. 25, No. 12, pp. 44, 46.) A supersonic (30–100 kc/s) current mixed with the signal in the recording head decreases distortion. Wire speed must exceed a minimum value to obtain best signal to noise ratio. Loss after 1 400 repeated playings is about 8 db. Report of an I.R.E. paper.

621.395.645.3 **837**

A De-Luxe 60-Watt Amplifier.—G. M. King. (*R.S.G.B. Bull.*, Dec. 1945, Vol. 21, No. 6, p. 90.) Circuit and design details of an audio-frequency amplifier, using valves of the 807 or 6L6 type, for use with a low-output high-quality microphone.

621.395.645.36 **838**

Quality Amplifiers.—(*Wireless World*, Jan. 1946, Vol. 52, No. 1, pp. 2–6.) Details are given of 4, 8 and 12 W circuits with double push-pull resistance-coupled triode stages.

621.395.92 : 534.771 **839**

The 6BP Audiometer.—A. H. Miller. (*Bell Lab. Rec.*, Dec. 1945, Vol. 23, No. 12, pp. 464–465.) One control dial adjusts frequency over the range 128 to 9 747 c/s ; a second dial indicates hearing loss over the range − 15 to + 105 db from standard. The patient, using either an air-conduction or a bone-conduction receiver, indicates with a push-button whether or not he hears the tone.

787.1/.4] : 534.31 **840**

The Mechanical Action of Instruments of the Violin Family.—F. A. Saunders. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 169–186.)

789 : 621.38 **841**

Old and New Sounds produced by Electrical Musical Instruments.—H. Bode. (*Funktech. Mh.*, May 1940, No. 5, pp. 67–74.) A brief survey of the subject of electrical musical instruments, with a description in more detail of the Melodium produced by the author and O. Vierling. The Melodium is a single-note instrument with a keyboard. A resistance-capacitance oscillator has its resistance selected by the key, and gives an output rich in harmonics. The key also sets the frequency of a filter that determines the musical quality of the note. The amplitude is determined by the force with which the key is depressed. Vibrato, pizzicato, and frequency multiplication and division to give coupling and mixture effects can be introduced by the performer.

A short description is given of an organ that depends on neon-lamp oscillators.

534 **842**

The Theory of Sound [Book Review].—Lord Rayleigh. Dover Publications, New York, 1945, 984 pp., $4.95. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, p. 301.) With an historical introduction by R. B. Lindsay.

534.321.9 **843**

Grundlagen und Ergebnisse der Ultraschallforschung [Book Review].—E. Heidemann. W. de Gruyter & Co., Berlin, 1939, 287 pp., RM 24. (*Z. Ver. dtsch. Ing.*, 22nd June 1940, Vol. 84, No. 25, p. 444.) A comprehensive survey, with a bibliography of 1346 items.

534.833 **844**

Schalldämmungs-Messungen im Laboratorium und in fertigen Gebäuden [Book Review].—W. Bausch. R. Oldenbourg, Berlin, 1939, 33 pp., RM 6.40. (*Z. Ver. dtsch. Ing.*, 15th June 1940, Vol. 84, No. 24, p. 424.) Deals with sound absorption measuring technique in relation to sound-proof buildings.

AERIALS AND TRANSMISSION LINES

621.315.2.029.6 **845**

Problems in the Manufacture of Ultra-High-Frequency Solid-Dielectric Cable.—A. J. Warner. (*Waves and Electrons*, Jan. 1946, Vol. 1, No. 1, pp. 31–37.) A brief description is given of the various types of u.h.f. cables. The manufacture is outlined with an indication of the difficulties of maintaining a constant characteristic impedance and of preventing the braid from becoming buried in the insulating sheath. The relative merits of long- and short-lay braiding and the effect of plating the braid is discussed. The attenuation increases as the lay angle increases but is almost independent of the percentage coverage between 98 and 80%. The attenuation introduced by each component of a typical cable is given. Production methods for the measurement of capacitance, velocity of propagation, attenuation and dielectric strength are outlined. Early international standardization of cables is recommended.

621.315.21.029.6.091 : 621.317.79 **846**

Attenuation Test Equipment for V-H-F Transmission Lines.—Muller & Zimmerman. (*See* 982.)

621.392 + 621.396.616 + 621.317.763 **847**

The Transverse Electric Modes in Coaxial Cavities.—Kirkman & Kline. (*See* 888.)

621.392 **848**

Vectorial Treatment of Transmission Lines.—J. P. Shanklin. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 162..166.) Graphical solution of transmission-line problems by representing current and voltage as vectors, and distance along the line as phase displacement. Typical problems are solved.

621.392 **849**

Propagation of Electromagnetic Waves in Branched Hollow-Pipe Lines.—E. M. Studenkov. (*J. Phys., U.S.S.R.*, 1943, Vol. 7, No. 6, pp. 308–309.) A brief description of experiments with waveguides using wavelengths of 8–11 cm. Methods are considered whereby the type of standing wave may be transformed by the introduction of sharp bends and branches into the waveguides. Typical transformations are : an E_0 type into an H_1 type, or H_0 into H_1, and *vice versa*.

621.392 : 534.213.4 **850**

The Analysis of Plane Discontinuities in [acoustic] **Cylindrical Tubes.**—Miles. (*See* 815 & 816.)

621.396.67 **851**

Concerning Hallén's Integral Equation for Cylindrical Antennas.—S. A. Schelkunoff. (*Proc. Inst. Radio Engrs, N.Y.*, Dec. 1945, Vol. 33, No. 12, pp. 872–878.) An explanation of the quantitative discrepancy between the impedance of a cylindrical aerial calculated by Hallén's formula (2763 of 1939) and that of the author (1049 of 1942). Hallén's solution involves the tacit assumption that the aerial is short compared with the wavelength as well as being thin, and this degrades the successive approximations. Gray's solution (1931 of 1944) does not involve this assumption, and gives satisfactory results. Infinitely long aerials are considered, and the results obtained compared with those of Stratton and Chu (1888 of 1941). An explanation of the discrepancy is given.

621.396.67 **852**

Principal and Complementary Waves in Antennas.—S. A. Schelkunoff. (*Proc. Inst. Radio Engrs, N.Y.*, Jan. 1946, Vol. 34, No. 1, pp. 23–32.) The paper is an extension of the analysis in 1049 of 1942 (Schelkunoff) to cylindrical antennas whose diameters are not small compared with the wavelength. " . . . the principal feature of the method is: waves in infinitely long antennas are considered first; subsequently, the complementary waves are included to express the effect of sudden termination of the wires, particularly with regard to uneven reflection at the wavefront passing through the end of the antenna." The effect of a finite source is discussed, and the simplifications when the antenna is thin are given.

621.396.67 **853**

On the Distribution of Current along Asymmetrical Antennas.—C. W. Harrison, Jr. (*J. appl. Phys.*, July 1945, Vol. 16, No. 7, pp. 402–408.) The first system analysed is a vertical grounded antenna over an infinitely conducting earth, fed at a point remote from the earth. This is treated as an isolated antenna fed symmetrically by two generators at points equidistant from the centre. The second system considered is an isolated linear antenna fed at a point not at the centre, and it is shown that the behaviour of the first system can be derived from that of the second. The basic equations for the current distributions are derived from the field equations, and approximate formulae suitable for computation are given. The results are fundamental to the solution of many advanced antenna problems.

621.396.67 **854**

Symmetrical Antenna Arrays.—C. W. Harrison, Jr. (*Proc. Inst. Radio Engrs, N.Y.*, Dec. 1945, Vol. 33, No. 12, pp. 892–896.) Calculation of the input impedance of a symmetrical aerial system consisting of identical radiators at the vertices of a regular polygon. The modified case of a symmetrical array with an additional central radiator is briefly discussed. Several practical applications of the theory are mentioned, particular reference being made to the case of corner-reflector aerials.

621.396.672 + 621.396.677 **855**

The Half-Rhombic Antenna.—J. H. Mullaney. (*QST*, Jan. 1946, Vol. 30, No. 1, pp. 28–31.) An elementary account of the construction and properties of the half-rhombic antenna, comprising an inverted-V aerial with a single-wire counterpoise.

621.396.674 : 621.314.2 **856**

Loop-Antenna Coupling-Transformer Design.—W. S. Bachman. (*Proc. Inst. Radio Engrs, N.Y.*, Dec. 1945, Vol. 33, No. 12, pp. 865–867.) "The low-impedance loop coupling-transformer circuit is analyzed, expressing the transformer parameters in terms of the circuit and transformer coupling coefficients. Equations are developed which yield optimum design values for the transformer. It is shown that an ideal transformer-coupled loop has 38.4 per cent. of the gain realizable from a direct-connected loop of the same area, assuming the same *Q* in the transformer secondary as in the direct-connected loop."

621.396.677 **857**

Small-Dimensional Radiating and Receiving Systems of High Directivity.—S. A. Makov. (*C.R. Acad. Sci. U.R.S.S*, 20th Aug. 1940, Vol. 28, No. 5, pp. 418–422.) Acoustic and radio systems, small compared with the wavelength, and with practically constant directivity over a range of frequencies, can be formed from a number of non-directional radiators by suitable adjustment of the phase and amplitude of their outputs. Three equally spaced collinear point sources, separated by $d/2$, the outer pair operated in equal amplitude and phase, the other adjusted in amplitude and phase to cancel the signal in the direction of the line of sources, give a polar diagram of the form $R_a \doteqdot \cos^2 \alpha$ for $0 < d/\lambda < 0.5$. Three-element rectilinear systems directed along the line of sources by making the centre source cancel the effect of the other two in the broadside direction give similar broad frequency bands of operation. The directivity can be improved by using more sources, while maintaining a wide frequency range of operation.

Combinations of such systems in perpendicular directions, or the use of point and annular sources give three-dimensional directivity.

621.396.677.2 + 621.396.71 **858**

Stepping Up from ¼ KW to 5 KW [and the use of a directional aerial].—Griffiths. (*See* 1057.)

621.396.67 + 621.396.11 **859**

Antenne e propagazione delle onde elettromagnetiche (per ingegneri) [Book Review].—B. Peroni. Michele dell'Aira, Rome, 372 pp. (*Wireless Engr*, Feb. 1946, Vol. 23, No. 269, p. 57.) "It can certainly be recommended to any advanced student or radio engineer with a knowledge of Italian or the desire to acquire such knowledge."

CIRCUITS

621.3.012.8 **860**

Determination of the Individual Resistances of a Delta Mesh by Measurements Taken at the Junctions.—L. J. Purnell. (*Elect. Engng, N.Y.*, Sept. 1945, Vol. 64, No. 9, p. 348.) Letter giving formulae.

621.314.2 **861**

Phase Splitter.—L. A. Saunders. (*Electronic Engng*, Feb. 1946, Vol. 18, No. 216, p. 63.) Letter describing an improvement in the phase-splitting circuit given in 295 of February, by the use of a double triode for phase splitting. This circuit will reject in-phase signals as in the Offner biological amplifier (1713 of 1937).

621.314.3 : 578.088.7 **862**

"Biological Amplifiers".—D. Robertson. (*Wireless World*, Jan. 1946, Vol. 52, No. 1, p.27.) Letter on 45 of January and 296 of February (Parnum) discussing reduction of mains-frequency interference.

621.385.032.442 : 621.3.025.4 **863**

Polyphase from Single Phase for Valve Supply Circuits.—E.M.I. Laboratories. (*Electronic Engng*, Feb. 1946, Vol. 18, No. 216, p. 55.) Circuits for obtaining polyphase supply for filaments of transmitting valves in order to reduce hum modulation.

621.385.2/.3].012.8 **864**

Triode Equivalent Circuits.—D. A. Bell. (*Electronic Engng*, Feb. 1946, Vol. 18, No. 216, pp. 56–57.) An ordered discussion on equivalent circuits for diodes and triodes, starting from first principles, and paying special attention to phase conventions. Voltage- and current - generator equivalents of amplifying triodes are compared.

621.392.43 **865**

Graphical Method of Determining the Resistance Transformation of Complex Resistances by means of a Capacitance assumed to be Loss-Free.—Geschwinde. (*Funktech. Mh.*, Sept./Oct. 1943, Nos. 9/10, pp. 89–94.) The purpose of the method is to find the value $-jX_T$ of the loss-free capacitive reactance that must be connected in shunt with a particular impedance $R + jX$ in order that the reactive or resistive part of the equivalent series impedance, $r - jx$, of the combination shall have an assigned value. Formulae are derived and charts are given connecting X/X_T with $R/|X_T|$ and x/X_T with $r/|X_T|$ for different values of R/r between 0.01 and 10. Charts are also given connecting $\pm X_T/X$ with R/r and x/X for different values of $R/|X|$ between 0.01 and 10^4. Examples of the use of these charts for matching *e.g.* an aerial to a transmitter are worked out.

621.392.5 **866**

General Formulas for “ T ”- and “ Π ”-Network Equivalents.—M. B. Reed. (*Proc. Inst. Radio Engrs, N.Y.*, Dec. 1945, Vol. 33, No. 12, pp. 897–899.) “ . . . the development of two sets of general formulas which determine a set of “ T ” or “ Π ” impedances equivalent to any linear, lumped-constant, four-terminal network.”

621.392.5 : 621.316.722.078.3 **867**

The Theory of the Non-Linear Bridge Circuit as Applied to Voltage Stabilizers.—G. N. Patchett. (*J. Instn elect. Engrs*, Part III, Jan. 1946, Vol. 93, No. 21, pp. 16–22.) Analysis of four arrangements of bridge elements obeying the law $V = kI^n$. Formulae are tabulated giving dV_{output}/dV_{input} for various circuit conditions, and giving circuit parameters necessary for maximum power output. A review of the properties of different bridges indicates the use of two non-linear elements in opposite arms to be the best.

621.392.5 : 621.317.725 : 621.385 **868**

Bridge Circuits with a Non-Linear Element: Valve-Voltmeter with a Stable Zero Adjustment.—Levy. (*See* 976.)

621.392.52 + 621.318.72 **869**

“ Abacs for Filter Design”.—T. Roddam. (*Wireless World*, Jan. 1946, Vol. 52, No. 1, p. 31.) Correction of error in 52 of January.

621.392.52 **870**

Transient Response of Filters [part 1].—D. G. Tucker. (*Wireless Engr*, Feb. 1946, Vol. 23, No. 269, pp. 36–42.) “ It is shown that the normal treatments of the transient response of filters are either not sufficiently simple or are not really suitable for all types of filter ; the method which considers the filter as an idealized transmission characteristic is satisfactory for multi-section filters and gives results in simple terms, but for single-section filters a special treatment is desirable. A method of determining the build-up and decay characteristics is given for a single section of the “ 6-element symmetrical ” band-pass filter, and the type of equation obtained is of general application to other types of section.” The treatment of Carson and Zobel (*Bell Syst. tech. J.*, July 1923, pp. 1–52.) is compared with the idealized transmission characteristic approach. Only band-pass filters are considered, but it is shown that the analysis is, for most purposes, also applicable to low-pass filters. The first of two parts.

621.392.52 **871**

Filter Design Tables Based on Preferred Numbers : Low-Pass Filters.—H. Jefferson. (*Wireless Engr*, Jan. 1946, Vol. 23, No. 268, pp. 26–28.) Tables are given to facilitate the design of low-pass filters using preferred (standard) values of components. See also 3823 of 1945.

621.392.52 **872**

Double-Derived Terminations.—R. O. Rowlands. (*Wireless Engr*, Feb. 1946, Vol. 23, No. 269, pp. 52–56.) “ A method is described for connecting filters in series or parallel such that the real part of their impedance or admittance function is equivalent to that of a double *m*-derived section.”

621.392.52 + 621.318.7 **873**

Technical Applications of Filters.—G. Guanella. (*Schweiz. Arch. angew. Wiss. Tech.*, Jan. 1945, Vol. 11, No. 1, pp. 16–26.) Describes a wide range of types of filter construction for a wide range of frequencies and applications : use of sliding cylindrical shields as a means of varying the inductance of solenoidal coils : filters embodying quartz crystals, and the great advantages of calcium phosphate in this connexion : resonant cavity filters for use in the decimetre wave range : the use of solenoidal bi-filar windings as a means of discriminating between symmetrical and asymmetrical currents. The article concludes with a brief account of the voltage-distribution method of measuring impedance at very high frequencies.

621.394/.397].645 **874**

Cathode Bias : Design Data (1).—(*Wireless World*, Jan. 1946, Vol. 52, No. 1, pp. 21–22.) Formulae for calculating the frequency response of valves with automatic bias.

621.394/.397].645 **875**

Cathode-Follower Circuits.—K. Schlesinger. (*Proc. Inst. Radio Engrs, N.Y.*, Dec. 1945, Vol. 33, No. 12, pp. 843–855.) Analysis of the cathode-follower as an amplifier, an oscillator, or as a discriminator for detection of f.m. signals. The gain/frequency characteristics and bandwidth are calculated for various circuital arrangements and various coupling networks in an amplifier. The input capacitance and conductance are derived as functions of the cathode load. The condition for oscillation is deduced, and the design of a balanced oscillator up to 700 Mc/s is described. Used as a discriminator the cathode follower, though more elaborate than the conventional double-diode, has the advantages of a limiting action, of higher input impedance, and lower output impedance.

621.394/.397].645 **876**

Amplifier Circuit.—J. R. Ford. (*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, p. 128.) To eliminate distortion without reduction in gain, the grid of a second tube is connected to a point of zero signal potential but appreciable distortion potential, and the amplified output combined in antiphase with the output of the original tube. Summary of U.S. patent 2 379 699.

621.395.645 : 621.395.44 **877**

A New Method of Amplifying with High Efficiency a Carrier Wave Modulated in Amplitude by a Voice Wave.—S. T. Fisher. (*Proc. Inst. Radio Engrs, N.Y.*, Jan. 1946, Vol. 34, No. 1, pp. 3–13.) Description and analysis of a new amplifier circuit. The input wave is divided into sections on an amplitude basis, and after high-efficiency amplification of each section, recombination reproduces the original wave form. The circuit employs valves with suitable separate grid drives, biases and load impedances; in practice 3 or 4 branches give satisfactory compromise between efficiency and complexity. The technique is specially suitable for controlled-carrier systems. Efficiencies about 5 times better than with existing systems are obtainable, and the power dissipation of the output stage is reduced, the advantages being greatest at low modulation levels.

621.395.645.36 **878**

Quality Amplifiers.—(*Wireless World*, Jan. 1946, Vol. 52, No. 1, pp. 2–6.) Details are given of 4, 8 and 12W circuits with double push-pull resistance-triode stages.

621.395.645.36 **879**

Push-Pull Circuit Analysis: Cathode-Coupled Output Stage.—S. W. Amos. (*Wireless Engr*, Feb. 1946, Vol. 23, No. 269, pp. 43–46.) "This circuit is one in which one output valve derives its input by cathode-coupling from the other . . ." "It is the purpose of this analysis to find the effect of varying R_0 [the resistance connecting the junction of the two grid leaks to h.t. negative] on the performance of the circuit and hence to find . . . its optimum value."

621.395.665 **880**

Resistive Attenuators, Pads and Networks: Parts IX and X.—P. B. Wright. (*Communications*, Oct. 1945, Vol. 25, No. 10, pp. 72..106, & Nov. 1945, Vol. 25, No. 11, p. 61.) IX. Consideration of representative examples. X. Particulars of a four-channel series-parallel mixer and fader system.

Series concluded. For previous parts see 60 of January and back references.

621.396.615 : 621.394/.397].645.34 **881**

Self-Excitation and Regeneration.—K. Eisenmann. (*Funktech. Mh.*, Sept./Oct. 1943, Nos. 9/10, pp. 95–100.) There can be no doubt that the equating to unity of the product of the amplification (V) and back-coupling factor (K) adequately represents the condition of stationary self-excited oscillations, but it is not immediately apparent that the condition must *necessarily* be fulfilled, especially if an exponentially damped oscillation is introduced as the initiator of the self-maintained oscillation, the frequency of the initiator being not necessarily the same as that of the self-maintained oscillation. The build-up of oscillation is traced in this paper to determine the frequency of the self-maintained oscillation from the frequency of the initiator. Conditions of stability in externally excited regenerative amplifiers are first examined. For similar work by the same author see 3122 of 1944. Self excitation is then considered when a parallel resonant circuit is connected into the regenerative system. It is assumed that switching on the d.c. supply charges the capacitor of the resonant circuit, which starts a damped oscillatory discharge. It is deduced that in addition to this decaying oscillation there is another oscillation that grows exponentially and becomes stationary when KV becomes unity. The amplitude of the stationary oscillation is greater than the initiating oscillation by a factor equal to the reciprocal of the logarithmic decrement of the resonant circuit. The frequency of oscillation differs, but always by very little, from the resonant frequency. A transient fluctuating distortion oscillation is superimposed on the main steady oscillation; it is smaller than the latter by the product of the period of the tuned circuit and its damping factor (R/2L).

621.396.615.072.9 **882**

Forced Oscillations in Oscillator Circuits, and the Synchronization of Oscillators.—D. G. Tucker. (*J. Instn elect. Engrs*, Part I, Jan. 1946, Vol. 93, No. 61, pp. 57–58.) Long abstract of 3825 of 1945.

621.396.615.14.029.63 **883**

A Coaxial Modification of the Butterfly Circuit.—E. E. Gross. (*Communications*, Dec. 1945, Vol. 25, No. 12, pp. 42–43.) The outer conductor of the coaxial cylinder has two 105° sections cut away, and two 75° thick metal sectors rotate between inner and outer conductors. Frequency range, with a lighthouse valve, is 620–1 340 Mc/s, power output 0.15 to 0.3 W. Report of an I.R.E. paper.

621.396.615.17 **884**

Low Frequency Multivibrators.—C. J. Quirk. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 350..360.) Very-low-frequency multivibrators may be obtained by omitting the grid leaks of the valves and relying on the leakage of the capacitors to discharge them. The periodicity is dependent on the quality of the capacitor and possibly on the leakage paths in the valves. Periods up to about 2 hours are discussed.

621.396.615.17 : 621.317.755 **885**

A Single Sweep Time Base.—D. McMullan. (*Electronic Engng*, Feb. 1946, Vol. 18, No. 216, pp. 47–50.) The time base was described in Part I of the paper (see 571 of March). The present paper gives details of the basic circuit and of practical operational points. Performance figures are stated and methods of use described in Part I are discussed in further detail.

621.396.615.17 : 621.317.755 **886**

Time-Base Converter and Frequency Divider.—H. Moss. (*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 158..160.) Long abstract with diagrams of 3266 of 1945. See also 308 of February.

621.396.615.17 : 621.317.755 **887**

Synchronous Time Base.—H. Moss. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 458..462.) Summary of 3266 of 1945. See also 308 of February.

621.396.616 + 621.392 + 621.317.763 **888**

The Transverse Electric Modes in Coaxial Cavities.—R. A. Kirkman & M. Kline. (*Proc. Inst. Radio Engrs, N.Y.*, Jan. 1946, Vol. 34, No. 1, pp. 14–17.) Study of the transverse modes TE $_{l,m,n}$ extending the treatment of Barrow and Mieher (2951 of 1940) and clarifying difficulties in their notation and pictorial representation. In particular the modes with $m = 0$ do not exist but are the limits of the modes for $m = 1$ when the radii of the conductors approach equality. The dependence of the modes on the ratio of the radii is discussed: for a given mode the resonant frequency decreases as the ratio approaches unity. The practical importance of coaxial transverse electric modes is stressed, *e.g.* in a wavemeter.

621.396.619 **889**

Single-Sideband Generator.—M. A. Honnell. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 166–168.) The system described avoids the use of highly selective filters for eliminating the unwanted sideband. Two separate balanced modulators are used; the carrier and modulation voltages applied to modulator 1 are respectively in quadrature with those applied to modulator 2. By suitably combining the modulator outputs either sideband may be selected. The system is of particular advantage at a fixed modulation frequency: a design of 90° phase shifter is described, however, which has a shift lying within 0.2° of 90° for all frequencies in the band 100 to 5 000 c/s.

621.396.621.52 **890**

The Super-Regenerative Detector: an Analytical and Experimental Investigation.—Strafford. (*See* 1032.)

621.396.622 : 621.396.619.018.41 **891**

A New F.M. Detector-Circuit [requiring no limiter].—G. G. (*QST*, Jan. 1946, Vol. 30, No. 1, pp. 26–27.) See 574 of March.

621.396.645.2 **892**

Pulse Amplifier Coupling.—S. Moskowitz. (*Communications*, Oct. 1945, Vol. 25, No. 10, pp. 58, 88.) An analysis of a method of calculating the response of resistance-capacity amplifier coupling circuits to pulse voltages.

621.396.645.3 : 621.396.621.55 : 621.396.61 **893**

A Coil-Neutralized Vacuum-Tube Amplifier at Very-High Frequencies.—R. J. Kircher. (*Proc. Inst. Radio Engrs, N.Y.*, Dec. 1945, Vol. 33, No. 12, pp. 838–843.) Neutralization of a triode is achieved (at one frequency) by tuning out the grid-anode capacitance by means of a parallel inductance; at v.h.f. an open $\lambda/2$ line can be used without the need for a blocking condenser. The neutralization so obtained is comparable with that existing in small pentodes. A 2-stage amplifier for 140 Mc/s using the Western Electric 299Y triode is described, with details of technique of adjustment and measurement of performance. A 3-db bandwidth of 4.3 Mc/s and a non-oscillating frequency range of 15.4 Mc/s are quoted. Measurements of distortion characteristics using a two-frequency generator and harmonic analyser showed that for a peak power output of 23 W the third-order distortion is – 44 db, and the fifth-order distortion better than – 60 db.

621.396.662 : 621.396.61 **894**

A Radio-Frequency Auto-Resonator.—Clemens. (*See* 1099.)

621.396.662.34 **895**

H.F. Band-Pass Filters: Part I.—H. P. Williams. (*Electronic Engng*, Jan. 1946, Vol. 18, No. 215, pp. 24–26.) Theoretical properties in a form suitable for engineers designing radio circuits.

621.396.662.34 **896**

H.F. Band-Pass Filters: Part II. – Similar Circuits.—H. P. Williams. (*Electronic Engng*, Feb. 1946, Vol. 18, No. 216, pp. 51–54.) A simple method for studying the characteristics of band-pass filters, making use of the fact that they have Q values of 20 and upwards. An approximation is made in the expression for series impedance near resonance, and a parameter for distance off tune is introduced. Various types of coupling are discussed. For part I see 895 above.

621.396.665 **897**

Radio Design Worksheet: No. 42. – Some Notes on Automatic Volume Control; Parallel Resonance.—(*Radio, N.Y.*, Nov. 1945, Vol. 29, No. 11, pp. 51–52.) Application of simple time-constant theory to the design of orthodox a.v.c. circuits.

621.396.822 **898**

[Noise] **Fluctuations of Electric Current.**—Bell. (*See* 1038.)

621.396.822 **899**

A Theory of Valve and Circuit Noise.—Campbell & Francis. (*See* 1037.)

621.397.62 **900**

The DC Restorer: Its Uses in Television and Radar.—(*Wireless World*, Jan. 1946, Vol. 52, No. 1, pp. 8–11.) A descriptive article.

621.397.813 **901**

Theoretical Investigation of the Distortion of Television Signals in Valve Circuits.—J. Huber. (*Schweiz. Arch. angew. Wiss. Tech.*, Mar. 1945, Vol. 11, No. 3, pp. 77–86.) Essentially a theoretical analysis of the response of a typical circuit consisting of a valve with a 4-pole network in the anode circuit, to the kind of excitation which occurs in the reception of the modulation corresponding to the usual types of test-picture. The method of analysis is the use of the Laplace transform in the form $f(p) = p\int_0^\infty \epsilon^{-pt} F(t)dt$, following Wagner. The results of the analysis are applied in detail to particular types of anode-circuit network, *e.g.* a resistance-capacitance amplifier, and a band-pass filter network, the equations of which are expressed in matrix form, following Feldtkeller. To be continued.

621.3.01/.02 **902**

Elementary Electric-Circuit Theory [Book Review].—R. H. Frazier. McGraw-Hill, New York & London, 1945, 434 pp., $4.00. (*Nature, Lond.*, 5th Jan. 1946, Vol. 157, No. 3975, p. 4.) "... the author has gone so thoroughly into basic circuit theory that the term 'elementary' cannot be justified." "A very real and useful approach to the relationship between the fundamental essentials ... and their applications. ..." See also 69 of January.

GENERAL PHYSICS

530.145.6 : 537.212 **903**

On Different Ways of Representing a Homogeneous Electric Field in Wave Mechanics.—F. Sauter. (*Ann. Phys., Lpz.*, 1943, Vol. 43, Nos. 6/7, pp. 404–416.) A mathematical discussion of the wave-mechanical analogy of the non-uniqueness of the scalar and vector potentials corresponding to the electric and magnetic field vectors of the classical theory.

534.321.9 **904**

New Aspect of Ultrasonics.—B. K. Sahay. (*J. acoust. Soc. Amer.*, Jan. 1946, Vol. 17, No. 3, pp. 285–286.) The study of ultrasonics may reveal a corpuscular nature of sound energy.

535.14 + 537.122 **905**

A New Classical Theory of Photon and Electron.—B. M. Sen. (*Sci. Culture*, Jan. 1946, Vol. 11, No. 7, pp. 387–388.) Short preliminary report of a theory designed to overcome deficiency in the Einstein equation $W = h\nu$ associating a quantum $h\nu$ with every e.m. wave, which is regarded as an over-generalization.

537.122 **906**

The Size of an Electron and the Nature of its Mass.—G.W.O.H. (*Wireless Engr*, Feb. 1946, Vol. 23, No. 269, pp. 33–35.) An editorial in which the radius of the electron is derived on the assumption that its apparent mass is inertial and due to its magnetic field. The charge may be considered to be distributed either uniformly over its surface or uniformly throughout its volume, leading respectively to values of 1.88 and 2.256×10^{-13} cm for the electronic radius.

537.212 **907**

Erratum : A Generalization of the Dielectric Ellipsoid Problem.—R. Clark Jones. (*Phys. Rev.*, 1st/15th Nov. 1945, Vol. 68, Nos. 9/10, p. 213.) Correction to 4068 of 1945.

537.22 **908**

The Basic Mechanisms of Static Electrification.—L. B. Loeb. (*Science*, 7th Dec. 1945, Vol. 102, No. 2658, pp. 573–576.) A short review of processes which produce static electricity. The five mechanisms discussed are (a) electrolytic effects, (b) contact electrification between surfaces, (c) spray electrification, (d) frictional electrification, (e) electrical effects in gases and flames. The need is stressed for further work to clarify the exact mechanism involved in each of these processes.

537.52 **909**

On the Mechanism of Spark Formation.—S. Teszner. (*C. R. Acad. Sci., Paris*, 5th & 19th March 1945, Vol. 220, Nos. 10 & 12, pp. 307–309 & 390–392.) An attempt to explain the discrepancy between the time observed to be required for a spark to build up in a gas (order of 10^{-8} sec) and the time implied by Townsend's theory (10^{-4} – 10^{-5} sec), in terms of the effect of negatively charged particles that are in front of and are carried along by the avalanche.

537.523.2 **910**

On the Velocity-Distribution of Electrons in [cold-cathode] **Field Emission.**—Müller. (*See* 1104.)

537.529 + 621.315.611.015.5 **911**

The Electrical Breakdown of Solid Dielectrics.—Krassin. (*See* 948.)

537.533.8 **912**

On Secondary Emission from Films of Pure Metals in the Ordered and Unordered States, and their Penetrability by Secondary Electrons.—Suhrmann & Kundt. (*See* 939.)

538.32 : 621.385.832 **913**

Another Problem of Two Electrons.—G.W.O.H. (*Wireless Engr*, Jan. 1946, Vol. 23, No. 268, pp. 1–2.) A discussion of an alleged fallacy relating to the forces between two electrons following parallel paths in a c.r. tube beam. It is shown that the apparent fallacy arises from a misinterpretation of the idea of relative velocity as between the electrons and the remainder of the system and an observer, and detailed analysis of the system as a unit shows the behaviour to be quite self-consistent. See also 2765 of 1944.

621.385.833 **914**

Electron Beams in Strong Magnetic Fields.—Pierce. (*See* 1112.)

535.22 **915**

The Velocity of Light [Book Review].—N. E. Dorsey. The American Philosophical Society, Philadelphia, 1944, 110 pp., $2.50. (*Rev. sci. Instrum.*, Oct. 1945, Vol. 16, No. 10, pp. 288–289.) " . . . will undoubtedly serve for many years as a convenient reference book on the subject." See also 590 of March.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.5 : 621.396.82 **916**

Listening in on the Stars.—O. G. Villard, Jr. (*QST*, Jan. 1946, Vol. 30, No. 1, pp. 59..122.) The short-duration whistles heard in certain circumstances when listening to a short-wave transmitter are explained in terms of interference introduced by radiation reflected from meteor trails. Methods of recognizing and observing the whistles are described. See also 3408 of 1944.

523.72 : 621.396.822 **917**

Signals from the Sun.—E. V. Appleton. (*Wireless World*, Jan. 1946, Vol. 52, No. 1, p. 29.) Article based on 323 of February (Appleton).

551.51.053.5 : 550.38 : 621.396.11 **918**

On the Influence of the Terrestrial Magnetic Field on the Reflection of Radio Waves from the Ionosphere.—Ginsburg. (*See* 1026.)

551.55 **919**

Wind Measurements at 30 Km.—N. K. Johnson. (*Nature, Lond.*, 5th Jan. 1946, Vol. 157, No. 3975, p. 24.) Letter reporting measurements on bursting smoke shells from a high-velocity gun in S.E. England. The wind is mainly easterly in summer with a mean velocity of 12 metres per second, and it is westerly in winter with a mean velocity of 37 metres per second.

551.5 **920**

Descriptive Meteorology [Book Review].—H. C. Willett. Academic Press, Inc., U.S.A., 1944, 310 pp, $4.00. (*Science*, 14th Dec. 1945, Vol. 102, No. 2659, pp. 624–625.) " . . . one of the few meteorological texts designed for use in undergraduate courses where students have had preparation in college mathematics and physics . . . indeed a welcome contribution . . ."

LOCATION AND AIDS TO NAVIGATION

621.3(41) " 1939/1945 " **921**

" British Electrical Engineers and the Second World War ".—P. Dunsheath. (*J. Instn elect. Engrs*, Part I, Jan. 1946, Vol. 93, No. 61, pp. 17–27.) The full paper, of which summaries were noticed in 415 of February and 729 of March.

621.385 + 621.396/.397 + 621.365.5 **922**

Results Achieved by a Large [French] **Industrial Research Centre** [Le Groupe Industriel des Compagnies Françaises de T.S.F. Associées] **During and Despite the Occupation.**—Brenot. (*See* 1105.)

621.396.9 **923**

Hyperbolic Navigation.—(*Electrician*, 1st Feb. 1946, Vol. 136, No. 3531, pp. 294–296.) Summary of a joint meeting of the Institution of Electrical Engineers and the Institute of Radio Engineers. J. A. Pierce read a paper, over short-wave radio from America, on " An Introduction to Hyperbolic Navigation". A discussion followed, a part of which was also heard in both countries.

621.396.9 **924**

" Loran " Guides Pilots.—W. Davis. (*Sci. News Lett., Wash.*, 3rd Nov. 1945, Vol. 48, No. 18, pp. 275–276.) A non-technical account of the history of Loran. Peacetime applications and costs are discussed.

621.396.9 **925**

Specialized Loran.—(*Sci. News Lett., Wash.*, 24th Nov. 1945, Vol. 48, No. 21, p. 324.) Sky-wave synchronized (S.S.) Loran has an over-land range of about 1 400 miles after sunset, compared with 200 miles obtained by using the ground wave. Brief note only.

621 396.9 **926**

Loran — the Latest in Navigational Aids : Part I, Fundamental Principles : Part II, Ground Station Equipment.—A. A. McKenzie. (*QST*, Dec. 1945, Vol. 29, No. 12, pp. 12–16, & Jan. 1946, Vol. 30, No. 1, pp. 54–57.)

621.396.9 **927**

Fundamentals of Radar : 4. — Pulse Methods Applied to Navigation.—(*Wireless World*, Jan. 1946, Vol. 52, No. 1, pp. 23–26.) An outline of the system using three fixed transmitting stations and a mobile receiver (Gee), and of the system using two fixed transmitting-receiving stations and a mobile responder (Oboe).

621.396.9 **928**

The Radar.—S. K. Mitra & J. N. Bhar. (*Sci. Culture*, Jan. 1946, Vol. 11, No. 7, pp. 343–353.) A semi-technical account of the principles and application of radar and various new aids to navigation. For Part 3 see 328 of February.

621.396.9 **929**

Manufacturer's Radar Display.—(*Electrician*, 14th Dec. 1945, Vol. 135, No. 3524, pp. 659–660.) Description of an exhibition by Ferranti at Moston.

621.396.9 **930**

Elements of Radar : Part I, Radar Pulses.—J. McQuay. (*Radio Craft*, Dec. 1945, Vol. 17, No. 3, pp. 169..204.)

621.396.9 **931**

Army and Navy Radar.—(*Electronic Industr.*, Oct. 1945, Vol. 4, No. 10, pp. 98–99.) Photographs of operational radar installations in the field and on board ship.

621.396.933.1 **932**

An Ultra-High-Frequency Radio Range with Sector Identification and Simultaneous Voice.—A. Alford, A. G. Kandoian, F. J. Lundburg & C. B. Watts, Jr. (*Waves and Electrons*, Jan. 1946, Vol. 1, No. 1, pp. 9–17.) A combination of two perpendicular aerial arrays, each consisting of three horizontal loops in line, the centre one common, is used to give aircraft course indication with unambiguous sector identification. One array gives an aural course by means of interlocked U and D morse patterns, using 1 020 c/s modulation frequency. The other provides a perpendicular visual course by the simultaneous transmission of 90 c/s and 150 c/s modulation, indication being by a centre-zero meter. The carrier (125 Mc/s) with voice modulation is radiated from the centre loop only. Earlier schemes and developments leading up to the final system are also described.

MATERIALS AND SUBSIDIARY TECHNIQUES

53.081.7(0 : 025.345) **933**

Card File of Physical Constants of Substances [" Annual Tables of Physical Constants "].—(*Nature, Lond.*, 29th Dec. 1945, Vol. 156, No. 3974, p. 775.) Numerical data of physical properties of substances are printed on 5 × 3 inch library cards, with one or more cards for each substance. It is planned to issue about 2 000 substance cards per year.

533.5 **934**

A Useful Seal for Dynamic Vacuum Systems.—D.D'Eustachio. (*Rev. sci. Instrum.*, Dec. 1945, Vol. 16, No. 12, pp. 377–378.) A " fairly soft " rubber stopper under compression seals electrodes or glass tubing, of up to several inches diameter, down to pressures of 10^{-6} mm of mercury.

533.5 **935**

Steel-to-Glass Vacuum Seal.—(*Rev. sci. Instrum.*, Oct. 1945, Vol. 16, No. 10, p. 298.) Note on a new R.C.A. technique due to G. R. Shaw.

533.5 **936**

The Hydrogen Gauge — An Ultra-Sensitive Device for Location of Air Leaks in Vacuum - Device Envelopes.—H. Nelson. (*Rev. sci. Instrum.*, Oct. 1945, Vol. 16, No. 10, pp. 273–275.) " . . . a sealed-off, highly evacuated ionization gauge having a section of its envelope made of thin palladium sheet which, when heated is highly permeable to hydrogen. In use the gauge is connected to the manifold of a vacuum system with the palladium section isolating the vacuum of the gauge from that of the manifold. When the manifold or any vacuum device connected to it is probed with hydrogen, leaks in the system are indicated by an increase in the ion current of the gauge." Leaks greater than 10^{-4} litre-micron per second are detected.

533.5 : 621.315.626 **937**

Ferranti Vacuum-Seal Bushing.—(*See* 1074.)

533.56 **938**

Small Oil Diffusion Type Vacuum Pump.—C. H. Bachman. (*Rev. sci. Instrum.*, June 1945, Vol. 16, No. 6, p. 153.) Description and drawing of a two-stage glass pump occupying a space about 5 × 6 × 2 inches. Speed 2 L/sec.

537.533.8 **939**

On Secondary Emission from Films of Pure Metals in the Ordered and Unordered States, and their Penetrability by Secondary Electrons.—R. Suhrmann & W. Kundt. (*Z. Phys.*, 23rd Feb. 1943, Vol. 120, Nos. 5/6, pp. 363–382.) Thin films of copper, gold, silver, and beryllium were condensed on to a glass plate in a vacuum at 83°A, and their secondary emission characteristics were studied, before and after raising to room temperature to convert the films from the unordered to the ordered state. Their penetrability was investigated by condensing the films on to a cooled highly-emitting beryllium cathode. It is concluded that the decrease in the secondary emission of compact metal films on passing from the ordered to the unordered states is only partially due to increased penetration by primary electrons. It must further be assumed that there are fewer absorbing and emitting centres in the ordered state.

539.234 **940**

Techniques for Evaporation of Metals.—L. O. Olsen, C. S. Smith & E. C. Crittenden, Jr. (*J. appl. Phys.*, July 1945, Vol. 16, No. 7, pp. 425–434.) Heaters are used in the form of open helical wire coils, close wound conical wire baskets, or ceramic crucibles formed on wire baskets. Evaporation has been carried out at temperatures up to 2 000°C and at pressures below 5×10^{-5} mm of mercury. Thirty-four elements have been studied for evaporation behaviour, and the preferred techniques for small and large quantities of each metal are tabulated.

539.234 : 621.396.611.21 **941**

Quartz Crystal Plating.—H. G. Wehe. (*Bell Lab. Rec.*, Dec. 1945, Vol. 23, No. 12, pp. 475–479.) Silver, aluminium or gold is deposited by evaporation onto the quartz in a high vacuum. The best distance of the quartz from the plating metal is dependent on a number of factors, which are discussed.

620.197 **942**

Surface-Conversion Coatings.—G. W. Jernstedt. (*ASTM Bull.*, Dec. 1945, No. 137, pp. 29–35.) Methods of producing protective surface coatings on metals by chemical reaction are described with details of the thickness of the films produced and their resistance to corrosive treatments. Most conversion coatings form a good base for protective lacquer or paint.

620.199.1/.9 **943**

Interference-Free Weatherometer.—W. B. R. Agnew. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 160–161.) "Accelerated weathering is applied to plastic and rubber materials and measured with photoelectric equipment. Automatic cycling of wetting and irradiation is provided and no radio interference is caused. The action is about ten times faster than outdoor exposure."

621.314.632 : 546.289 **944**

Germanium Rectifiers.—(*Electronic Engng*, Feb. 1946, Vol. 18, No. 216, p. 50.) Describes the use of germanium crystals as contact rectifiers for u.h.f. They may also be useful for voltage regulation.

A brief account of an I.R.E. paper by E. Cornelius, derived from a report in *Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, p. 80.

621.315.53/.54] : 621.315.68 **945**

Contact Connections in Aluminium and Magnesium Conductors.—R. Schulze & B. Zeisz. (*Z. Ver. dtsch. Ing.*, 8th June 1940, Vol. 84, No. 23, pp. 399–402.) At 300° the oxide layer on aluminium is very loosely attached and easily removed, and aluminium wires can easily be coated with a metal that melts at about this temperature ; or a short length of "Cupal" (copper plated aluminium wire) can be welded on to the end of the aluminium conductor. Wires so prepared can be soldered. Screw terminals or clamps for aluminium conductors must be of spring construction to allow for the flow of the aluminium. The junction of stranded aluminium conductors presents special difficulties and usually requires welding into special end-pieces. Strips can be joined by screwing or clamping, with a paste containing bronze or similar turnings which are driven into the contact surface by the pressure of the connexion. A similar technique can be used with magnesium strip.

621.315.61 **946**

Study of the Electrical Conductivity of Rare Oxides : Lanthanum, Praeseodymium, Neodymium and Samarium.—M. Foëx. (*C.R. Acad. Sci., Paris*, 12th March 1945, Vol. 220, No. 11, pp. 359–361.) Graphs are given showing the resistivities versus temperature of La_2O_3, Pr_2O_3, Pr_8O_{11}, Nd_2O_3 and Sm_2O_3 in atmospheres of air, oxygen, nitrogen and hydrogen, over the range of about 300–1200°C. The resistivities lie between 10^8 and 10^4 Ω.cm except for Pr_8O_{11} in oxygen, for which it is ess than about 10^2 Ω.cm.

621.315.611 : 621.317.3 **947**

Resonance Methods of Dielectric Measurement at Centimetre Wavelengths.—Horner, Taylor, Dunsmuir, Lamb & Jackson. (*See* 966.)

621.315.611.015.5 + 537.529 **948**

The Electrical Breakdown of Solid Dielectrics.—A. K. Krassin. (*C.R. Acad. Sci., U.R.S.S.*, 20th Sept. 1940, Vol. 28, No. 8, pp. 694–696. In German.) Consideration of the reason for the destruction of the material by the discharge. The appearance of a large number of electrons in motion in the insulator causes a loosening of the bond between the nodal particles of the lattice ; thus the electric field producing the electron current can finally destroy the connexion between the heavy charged particles that has already been modified by the electrons. The breakdown field alone would not destroy the lattice.

621.315.612.6.017.143.029.58/.62 **949**

Dielectric Losses of Different Glasses in the Short Wave Region and their Dependence on Temperature.—M. J. O. Strutt & A. van der Ziel. (*Physica, Eindhoven*, July 1943, Vol. 10, No. 7, pp. 445–450.) Results are given of measurements on heavy lead glass, soda glass (16% Na_2O) and boron glass (23% B_2O_3) at frequencies of about 12 and 50 Mc/s. Values of tan δ are plotted against temperature over the range 50–250°C. Earlier results at frequencies between 500 and 3.10^5 c/s are plotted for comparison. At the higher frequencies log tan δ is no longer proportional to temperature; the rate of change of log tan δ with temperature increases with temperature. The dielectric losses and permittivity vary less with temperature as the frequency is increased. The dielectric losses and change in permittivity are greater for the soda glass than for the other two.

The existence of this paper was noted in 1685 of 1944.

621.315.616.98 **950**

"Frozen" Electricity. The Electret.—T. A. Dickenson. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 88–89.) Manufacture, properties, and uses of wax blocks with permanent electric polarization similar to the permanent magnetism of magnets.

621.318.22 **951**

Physical Basis and Properties of Modern Magnet Steels and the Construction and Testing of Permanent Magnets.—E. Spahn. (*Schweiz. Arch. angew. Wiss. Tech.*, Oct. 1944, Vol. 10, No. 10, pp. 313–322.) A comprehensive survey covering the relation between magnetic characteristics and micro-structure, for pure metals and alloys, the properties of permanent magnets, the characteristics of modern magnet steels, method of measurement of magnetic characteristics, and methods of magnetization.

621.318.322 **952**

Hipersil - A Greatly Improved Transformer Iron.—T. D. Yensen. (*J. appl. Phys.*, July 1945, Vol. 16, No. 7, pp. 379–385.) Hipersil is a silicon-iron alloy with 3–4% silicon, in which hysteresis loss has been reduced by the removal of impurities, increase in grain size, and arrangement of the crystals to their optimum orientation. Losses are roughly 50% lower and flux densities 20–30% higher than in standard silicon-iron sheet for the same magnetizing force. Properties are shown graphically.

621.319.7 : 621.315.626 **953**

Graphical Field Mapping Applied to Bushing Insulator Design.—E. G. Wright & S. Deutscher. (*Beama J.*, Jan. 1946, Vol. 53, No. 103, pp. 29–37.) Following Kuhlmann (*Arch, Elektrotech.*, 1915, Vol. 3, pp. 203–225.) the case of three-dimensional fields with rotational symmetry for several dielectrics in series is developed for the practical cases of solid and oil-filled bushings.

621.791.76 **954**

A Simple Method for Spotwelding Thin Wires.—P. L. Copeland & K. Rothschild. (*Rev. sci. Instrum.*, Oct. 1945, Vol. 16, No. 10, pp. 293–294.) A capacitor charged from a potentiometer connected across a 110 V d.c. supply provides the energy to weld the wires. The energy required can be adjusted to optimum by the potentiometer tapping. The capacitance used is of the order of 2–100 μF depending on the size of the wires to be welded and the strength of the weld required.

669–181.32 **955**

On the Structural Changes in Metals by Cold Working.—W. Kranert & H. Raether. (*Ann. Phys., Lpz.*, 1943, Vol. 43, Nos. 6/7, pp. 520–537.) A very thorough investigation, by electron diffraction, of the effects of various kinds of cold working (polishing, pressing, rolling, etc.) on single-crystal surfaces of copper, gold, iron and nickel. (The subject has some bearing on the behaviour of sliding contacts and metal surfaces). The authors' conclusions are :—1. ". . . under the specified cold-working conditions, the surface of the copper is transformed into an extremely finely crystallized layer, a few tens of Ångstrom units in thickness, which, with increasing depth, gradually changes to a normal crystalline powder structure, and finally, at a depth of a few microns, reverts to the undisturbed mono-crystal form. 2. . . . the diagrams indicate that the disruption of the structure can be carried down to less than one or two 'elementary cells' [*Elementarzellen*], so that no distinction can be drawn between the fine-crystal and the quasi-fluid conditions. . . . In certain cases (for example, copper, iron, nickel) a thin fine-crystal oxide sheet covers the worked surface."

679.5 **956**

Plastics for the Amateur: Part I.—A. G. Chambers. (*R.S.G.B. Bull.*, Dec. 1945, Vol. 21, No. 6, pp. 85–87.) Details of material characteristics, uses, cementing methods, etc., of a number of plastics, including phenol-formaldehyde; urea-formaldehyde; methyl methacrylate ("perspex" etc.); polyethylene; polyvinyl chloride; polystyrene, etc.

679.5 **957**

A Review of Plastic Materials.—H. L. Brouse. (*Proc. Inst. Radio Engrs, N.Y.*, Dec. 1945, Vol. 33, No. 12, pp. 825–834.) "Common plastic materials are classified according to their thermal characteristics and the methods of fabrication. Typical physical and electrical properties are presented for each of the general class of materials. It is pointed out that such values are average, and do not indicate the range that can be obtained by selection of a specific molding powder. Common trade names, compositions, and their manufacturers are presented in the form of a cross-index for reference purposes. Factors governing the performance and the choice of a particular material are discussed. Expansion coefficients, as applied to the use of metal inserts molded into the material, light transmission properties, and the fabrication of laminates are briefly treated in the Appendix."

679.5 : 539.4 **958**

Strength and Permissible Loading of Polyvinyl Chloride Plastics.—W. Buchmann. (*Z. Ver. dtsch. Ing.*, 22nd June 1940, Vol. 84, No. 25, pp. 425–431.) A detailed discussion of the use of such materials as structural members, with particular reference to Igelit PCU (Vinidur). The chief point emphasized is that the duration of the stress has a marked effect, as in metals at high temperature, and that reliable data must therefore be based on very long period tests, lasting in some cases more than 1 000 hours. The paper gives data for a wide range of stresses and temperatures.

679.5 : 621.396.6 **959**

Plastics in Radio.—L. Laden. (*Radio News*, Dec. 1945, Vol. 34, No. 6, pp. 25–28, 159.) The properties and application of thermo-setting plastics and of the newer thermoplastic materials are described. Tables give dielectric constant, power factor, breakdown voltage, and resistivity of the important plastics, and indicate suitable materials and manufacturing methods for a large range of radio parts.

679.5 **960**

Modern Plastics [Book Review].—H. Barron. Chapman & Hall, London, 1945, 680 pp., 42s. (*Electronic Engng*, Jan. 1946, Vol. 18, No. 215, p. 31.) See also 359 of February.

679.5 **961**

The New Plastics [Book Review].—H. R. Simonds, M. H. Bigelow & J. V. Sherman. D. Van Nostrand Co., New York, 1945, 320 pp., $4.50. (*Science*, 7th Dec. 1945, Vol. 102, No. 2658, p. 600.) ". . . a semi-technical volume devoted almost exclusively to plastic materials, processes and uses which have been developed since 1940." ". . . an excellent attempt to condense the more important information into one volume."

MATHEMATICS

517.432.1 **962**

Symbolic Calculus and Discontinuities.—M. Bayard. (*Rev. gén. Élect.*, Dec. 1945, Vol. 54, No. 12, pp. 373–379.) It is shown that any uniform function, even if it has discontinuities of the first or second kind, can be rendered continuous by representation in terms of an integration of unit or unit-impulse functions. The procedure also leads to a criterion for the validity of Heaviside's asymptotic development of the image-function illustrated by reference to a classical case in which Heaviside's expansion is invalid.

517.93 **963**

Nonlinear Springs.—M. A. Sadowsky. (*J. Franklin Inst.*, Dec. 1945, Vol. 240, No. 6, pp. 469–476.) A new method for solving the nonlinear oscillatory equation $\ddot{y} + S(y) = 0$, giving an implicit presentation of the solution. Certain forms of $S(y)$, containing an arbitary parameter, are suitable for curve fitting and give solutions in terms of elementary functions. The simpler solutions are tabulated.

621.396.11 + 534.231 **964**

The Saddle-Point Method in the Vicinity of a Pole with Applications to Wave-Optics and Acoustics.—Ott. (*See* 1024.)

MEASUREMENTS AND TEST GEAR

621.3.018.41 : 621.3.081.3 **965**

New Frequency Unit.—P. M. Honnell. (*Elect. Engng, N.Y.*, Nov. 1945, Vol. 64, No. 11, p. 422.) A suggestion for a logarithmic scale of frequency, the unit defined as 1 marconi = $\log_{10} f$, with f in c/s.

621.317.3 : 621.315.611 **966**

Resonance Methods of Dielectric Measurement at Centimetre Wavelengths.—F. Horner, T. A. Taylor, R. Dunsmuir, J. Lamb & W. Jackson. (*J. Instn elect. Engrs*, Part III, Jan. 1946, Vol. 93, No. 21, pp. 53–68.) A detailed account of the theory, design and operation of apparatus for measuring the permittivity and power factor of solid dielectrics at frequencies $>$ 600 Mc/s. The relative merits of a short-circuited coaxial resonator operating in the principal mode, and of hollow cylindrical resonators in the E_{010} and H_{01n} modes are studied. The theory of resonance when wholly or partially filled with "lossy" dielectric is developed, connecting the dielectric properties with resonant frequency and Q.

621.317.32 : 621.3.015.33 **967**

Measurement of Impulse Voltages.—J. M. Meek. (*Electrician*, 30th Nov. 1945, Vol. 135, No. 3522, pp. 608–610.) Summary of I.E.E. paper and report of discussion. See also 365 of February.

621.317.33 **968**

Measurement Applications of the Dynatron.—W. M. Ross. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 320..328.) The dynatron circuit is useful for measurement of impedance and as an oscillator in test work. Reactance can be measured by a substitution method, a calibrated capacitor being used to restore the frequency to its original value after the unknown reactance component has been introduced into the circuit. Resistive components of impedance can be measured by finding the difference in grid bias settings required for oscillation to take place with and without the impedance connected. The use of the dynatron circuit in an a.f., r.f., or modulated r.f. oscillator gives good frequency stability and ease of amplitude control.

621.317.33 : 621.396.611.21 **969**

The Measurement of the Activity of Quartz Oscillator Crystals.—A. J. Biggs & G. M. Wells. (*J. Instn elect. Engrs*, Part III, Jan. 1946, Vol. 93, No. 21, pp. 29–36.) A useful criterion of "activity" is the value of the anti-resonant impedance of the crystal with a standard value of total shunt capacitance, *e.g.*, 30 $\mu\mu$F. Three general methods of measuring this impedance are given ; (*a*) an attenuation method of measurement in terms of a standard resistance, (*b*) a substitution method using the crystal as the anode load in an r.f. amplifier, and (*c*) a substitution method using the crystal as the oscillatory circuit in a valve oscillator. Activity meters for the frequency ranges 50 kc/s–20 Mc/s, 80 kc/s–3 Mc/s, and $>$3 Mc/s are described.

621.317.33 : 621.396.645 **970**

Measurement of Amplifier Input Impedance.—D. L. Waidelich. (*Communications*, Dec. 1945, Vol. 25, No. 12, pp. 48..97.) The voltage required at the generator is measured, for constant amplifier output, when the generator is connected to the amplifier input (1) directly, (2) through a known resistance, (3) through a known capacitance. From the three equations thus obtained the input reactance and resistance can be computed.

621.317.34 : 621.317.72 : 621.385 : 621.396.322 **971**

The Rectification of Signal and Noise.—V. J. Francis & E. G. James. (*Wireless Engr*, Jan. 1946, Vol. 23, No. 268, pp. 16–25.) "It is shown that the d.c. component of rectified noise, obtained with a square law triode, is not proportional to the mean square noise unless the valve is biased to cut-off. Unless this condition is fulfilled, errors as large as 3 db may be obtained if the assumption of proportionality is made. It is shown that a linear diode with a resistive load shunted by a large capacitor provides an accurate method of measuring noise. The mean rectified current with no applied signal is directly proportional to the r.m.s. noise input, the factor of proportionality being a function of the load resistance multiplied by the diode conductance.

When both noise and signal are present, the ratio of the rectified current to r.m.s. noise input is a function of the signal/noise input ratio and the product of load resistance and diode conductance. For the case of a diode operating on the exponential part of the characteristic, the rectified current is obtained for an input consisting of a mixture of signal and noise. Results are given for various values of signal input voltage and r.m.s. noise input. An indication is given of the type of transition to be expected between the exponential characteristic and the linear characteristic as the mean diode current increases."

621.317.35 **972**

A Simplified Method of Wave Analysis.—W. L. Cassell. (*Communications*, Dec. 1945, Vol. 25, No. 12, pp. 38..103.) The presence and value of any required harmonic can be determined by the addition of ordinates of superimposed equi-angular divisions (equal in number to the order of the harmonic sought) of one cycle of the complex wave. The superposition and addition of the divisions can be performed on a cathode-ray tube by adjustment of the time base.

621.317.361 **973**

Checking UHF Oscillator Stability.—L. E. Pinney. (*Electronics*, Dec. 1945, Vol. 18, No. 12, p. 139.) A simple untuned mixer circuit that may be connected to the input of a communications receiver to obtain a heterodyne beat between a standard oscillator and that under test.

621.317.42 **974**

The Fluxball : a Test Coil for Point Measurements of Inhomogeneous Magnetic Fields.—W. F. Brown, Jr. & J. H. Sweer. (*Rev. sci. Instrum.*, Oct. 1945, Vol. 16, No. 10, pp. 276–279.) " The value of a magnetic field at a point is equal to the volume average of the field over the interior of any sphere centred at the point and not containing any sources of the field. It is therefore possible to wind a coil on the surface of a sphere in such a way that the flux through the coil is proportional to the field at a point . . . Design formulas are derived and construction procedures described."

621.317.714 **975**

Measurement of Electric Currents by Means of a Mercury Manometer.—A. Kolin. (*Rev. sci. Instrum.*, Dec. 1945, Vol. 16, No. 12, pp. 378–379.) The mechanical forces produced when current flows through a mercury film in a magnetic field alter the level in a capillary tube. The sensitivity is 6 mm per ampere in a field of 2 300 gauss with a resistance of 10^{-3} Ω. A magnetic rather than an ohmic shunt should be used to increase the range of the instrument.

621.317.725 : 621.385 : 621.392.5 **976**

Bridge Circuits with a Non-Linear Element : Valve-Voltmeter with a Stable Zero Adjustment.—M. Levy. (*Wireless Engr*, Jan. 1946, Vol. 23, No. 268, pp. 3–7.) The instability of the " zero " of valve voltmeters due to variations of supply voltage is overcome (*a*) by biasing the valve so that over the expected range of variation of supply voltage the valve is effectively a linear device or (*b*) by inserting in one of the other arms of the bridge circuit a compensating network, composed of a neon tube and resistors, which simulates the non-linear characteristic of the valve. Stability of zero of about 1% of full-scale deflexion for 30% variation of anode voltage, or 10% variation of heater voltage is obtained.

621.317.73.029.62 **977**

VHF Impedance Measurements.—D. S. Henry. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 156–159.) Impedance measurements in the range 50–150 Mc/s are made by connecting the unknown across a high-Q circuit coupled to a resonant circuit. The resistive and reactive components are measured in terms of the ratio of the voltages across the resonant circuit, with and without the unknown impedance connected, and the change in capacitance required to tune it to resonance. A balanced valve voltmeter is used both to measure the voltages and as a resonance indicator.

621.317.738 **978**

Microfarad Meters : Their Advantages and Limitations.—R. P. Turner. (*Radio News*, Dec. 1945, Vol. 34, No. 6, pp. 46..147.) A.c. milliammeter, a.c. ohmmeter, and ratio dynamometer instruments give direct readings if the power factor is very small. Heterodyne meters are bulky, but readings are independent of power factor, voltage, and waveform.

621.317.75 **979**

Radio-Frequency Spectrum Analyzers.—E. M. Williams. (*Proc. Inst. Radio Engrs, N.Y.*, Jan. 1946, Vol. 34, No. 1, pp. 18–22.) The resolving power S of a radio-frequency spectrum analyser of the continuously tuned type is defined as the width in frequency, at points 3 db down, of the trace of a constant-frequency c.w. signal. Experimentally this has a maximum value given by $S = 1.3\ (F/T)^{\frac{1}{2}}$ (F = frequency band scanned, T = time of scan), and requires an i.f. bandwidth $\triangle f \approx (F/2T)^{\frac{1}{2}}$. Arguments based on the properties of a single tuned circuit are used to support these formulae. By similar methods the resolution required to separate the sidebands and the sideband envelope of pulsed signals is deduced. Spectra of pulse- and frequency-modulated signals are shown.

621.317.763 + 621.392 + 621.396.616 **980**

The Transverse Electric Modes in Coaxial Cavities.—Kirkman & Kline. (*See* 888.)

621.317.79 **981**

Probe Error in [waveguide] **Standing-Wave Detectors.**—W. Altar, F. B. Marshall & L. P. Hunter. (*Proc. Inst. Radio Engrs, N.Y.*, Jan. 1946, Vol. 34, No. 1, pp. 33–44.) The errors due to reflection from a probe are analysed assuming that it behaves as a shunt admittance. Measurements confirm the validity of the assumption over a wide range of penetrations up to 65% of the guide height. Even where bad distortion of the pattern is produced, three readings at specified probe positions are sufficient to give the true standing-wave ratio. Application of the results enables deeper penetrations to be used with increase of sensitivity. Geometrical representations of the vector relationships and curves of experimental patterns with various probe penetrations and standing-wave ratios are given.

621.317.79 : 621.315.21.029.6.091 **982**

Attenuation Test Equipment for V-H-F Transmission Lines.—F. A. Muller & K. Zimmerman. (*Communications*, Dec. 1945, Vol. 25, No. 12, pp. 54..60.) Impedance matching is obtained by adjusting the inductive coupling between test oscillator and line ; input and output voltages on the line can then be measured with a valve voltmeter. A frequency range of 100 to 400 Mc/s is covered by two oscillators. The apparatus is described.

621.317.791 **983**

The Audio Chanalyst.—A. Liebscher. (*Radio News*, Dec. 1945, Vol. 34, No. 6, pp. 32..100.) Another account of the instrument described in 3940 of 1945.

621.317.794 **984**

Alternating-Current Bolometer for Infra-Red Spectroscopy.—C. H. Schlesman & F. G. Brockman. (*J. opt. Soc. Amer.*, Dec. 1945, Vol. 35, No. 12, pp. 755–760.) The 1 000 c/s a.c. bridge is screened and contains resistance elements to improve temperature compensation. The detector amplifier has a maximum sensitivity of 0.1 μV for full-scale deflexion of the high-speed recorder used. The bridge power supply, derived from a tuning fork and amplifier, is voltage stabilized to better than 7 mV in 240 V over a half-hour. Sensitivity, limited by power supply instability, is 10^{-3} degree C for full scale, giving a minimum detectable change of 10^{-5} degree C.

621.396.62 **985**

Dynamic Handful Signal Tracer.—R. Bloom. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, pp. 98, 113.) A small indicator constructed from a midget radio receiver for r.f. and a.f. signal tracing when servicing receivers.

621.317.35 **986**

Waveform Analysis : A Guide to the Interpretation of Periodic Waves, including Vibration Records [Book Review].—R. G. Manley. Chapman & Hall, Ltd., London, 1945, 275 pp., 21s. (*Nature, Lond.*, 29th Dec. 1945, Vol. 156, No. 3974, p. 765.) See 3712 of 1945. "The author is to be congratulated on the completeness of his practical treatment, and the advice he has given in interpretation . . ."

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

535.6.08 : 612.1 : 621.317.39 **987**

A Simplified Photoelectric Colorimeter for Blood Analysis.—H. L. Andrews & B. L. Horecker. (*Rev. sci. Instrum.*, June 1945, Vol. 16, No. 6, pp. 148–152.) A comparison spectrophotometer suitable for clinical purposes, based on infra-red absorption phenomena. A meter indication derived from a photocell coupled to a linear amplifier gives percentage transmission as an indication of haemoglobin content.

545.721 : 545.83 : 621.38 **988**

Microanalytic Measurement of Oxygen Production.—P. Pringsheim. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 340..350.) Silica gel dyed with *e.g.* acriflavine, and highly evacuated, is phosphorescent to light, and the decay time after switching off the irradiating light source is dependent on the oxygen concentration in the surrounding medium, but is not affected by the other uncontaminated atmospheric gases. This property is used in measuring partial pressures of very small quantities of oxygen. The light-sensitive phosphor is irradiated periodically, and the decay time measured by an electronic device.

578.088.7 : 621.314.3 **989**

"Biological Amplifiers".—Robertson. (*See* 862.)

620.179 : 534.321.9 **990**

The Supersonic Reflectoscope, an Instrument for Inspecting the Interior of Solid Parts by Means of Sound Waves.—Firestone. (*See* 822.)

621.31 : 621.38 **991**

Application of Electronics in the Electric Power Industry.—C. F. Wagner. (*Elect. Engng, N.Y.*, Sept. 1945, Vol. 64, No. 9, pp. 323–327.) A general account of the use of mercury-arc rectifiers, a.m., f.m., and single-sideband carrier communications, dust precipitation, lighting, and cable testing.

621.317.39.082.7 **992**

An Electrical Moisture Meter.—C. F. Brockelsby. (*J. sci. Instrum.*, Dec. 1945, Vol. 22, No. 12, pp. 243–244.) "A moisture meter depending on the variation of dielectric constant is described. Measurements are made at a low radio frequency. The range of direct reading is 8–28% moisture content for wheat (for which the instrument was primarily designed) ; over the greater part of this range the probable error of a single reading is approximately ± 0.4% moisture content, taking one recognized oven method as the standard. Changes in moisture content of 0.2% can be detected." See also 388 of February.

621.317.39.082.7 **993**

An Electrical Moisture Meter.—L. Hartshorn & W. Wilson. (*J. Instn elect. Engrs*, Part I, Jan. 1946, Vol. 93, No. 61, pp. 56–57.) Long abstract of 388 of February.

621.365.2.076.7 **994**

Electronic Regulator for Arc Furnaces.—(*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 314..316.) A device to control the lowering of the electrode in an arc furnace, utilizing the furnace current and furnace voltage as initiating control-parameters.

621.365.5 + 621.365.9 + 621.369 **995**

The Place of Radiant, Dielectric and Eddy-Current Heating in the Process Heating Field.—L. J. C. Connell, O. W. Humphreys, & J. L. Rycroft. (*J. Instn elect. Engrs*, Part I, Dec. 1945, Vol. 92, No. 60, pp. 464–465.) Long summary of 145 of January.

621.365.5 + 621.385 + 621.396/.397 **996**

Results Achieved by a Large [French] **Industrial Research Centre** [Le Groupe Industriel des Compagnies Françaises de T.S.F. Associées] **During and Despite the Occupation.**—Brenot. (*See* 1105.)

621.365.5 **997**

An Introduction to the High-Frequency Induction Furnace.—J. H. H. Teece. (*J. Instn elect. Engrs*, Part I, Jan. 1946, Vol. 93, No. 61, pp. 50–51.) Abstract of an I.E.E. Students' Section Paper.

621.365.52 **998**

High Frequency Induction Furnace.—N. C. Saha. (*Electrotechnics*, Sept. 1945, Nos. 17/18, pp. 49–58.) A short general account of the main types of h.f. alternators, the design of the furnace, the theory of induction heat treating and its main uses.

621.365.92 **999**

Dielectric Heating Design Chart : A Correction. —(*Electronic Engng*, Feb. 1946, Vol. 18, No. 216, p. xiii following p. 60.) A correction to charts appearing in 3724 of 1945 (Maddock).

621.365.92 **1000**

Dielectric Heating Fundamentals.—D. Venable. (*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 120–124.) The basic molecular theory underlying the process of dielectric heating is briefly described. Power requirements, thermal losses, characteristics of the load, and types of networks for matching the load to the oscillator are discussed.

621.365.92 : 679.5.023 **1001**

The Hardening of Synthetic Resins in a High-Frequency Field.—H. Stäger & F. Held. (*Schweiz. Arch. angew. Wiss. Tech.*, Sept. 1944, Vol. 10, No. 9, pp. 259–268.) A detailed experimental study of the hardening process : includes measurements of the temperature changes in the specimen, and the variations of the electrical constants in the course of the hardening process.

621.383 : 621.385.15 : 621.314.2 : 535.24 **1002**

The Possibility of Comparing Unmodulated Luminous Fluxes by means of an Electron-Multiplier Photocell followed by an A.C. Amplifier.—Le Blan. (*See* 1088.)

621.385.833 + 537.533.72 **1003**

Rigorous Treatment of the Electrostatic Immersion Lens Whose Axial Potential Distribution is Given by $\phi(z) = \phi_0 e^{K \arctan z}$.—R. G. E. Hutter. (*J. appl. Phys.*, Nov. 1945, Vol. 16, No. 11, pp. 678–699.) This is the simplest electrostatic lens for which Newton's image equations are satisfied throughout the field. The general solution of the paraxial-ray differential equation is derived, from which all the important optical quantities can be obtained graphically.

621.385.833 + 537.533.72 **1004**

The Class of Electron Lenses which Satisfy Newton's Image Relation.—R. G. E. Hutter. (*J. appl. Phys.*, Nov. 1945, Vol. 16, No. 11, pp. 670–678.) A simple construction can be used to find the image of any object if the cardinal points of the lens are known, provided the object and image lie outside the region of the electromagnetic fields. It is shown that a class of electron lenses exists for which these image relations are satisfied for any object and image position. The results are compared with those of Glaser and Lammel (202 of 1942).

621.385.833 + 537.533.73 **1005**

High Dispersion Electron Diffraction by Primary Magnification.—G. L. Simard, C. J. Burton, & R. B. Barnes. (*J. appl. Phys.*, Dec. 1945, Vol. 16, No. 12, pp. 832–836.)

621.385.833 **1006**

Electron Microscopical Replica Techniques for the Study of Organic Surfaces.—R. B. Barnes, C. J. Burton & R. G. Scott. (*J. appl. Phys.*, Nov. 1945, Vol. 16, No. 11, pp. 730–739.)

621.385.833 **1007**

A Shadow Casting Unit for the RCA Electron Microscope.—H. R. Crane, H. Levinstein, & R. C. Williams. (*Rev. sci. Instrum.*, Oct. 1945, Vol. 16, No. 10, p. 296.)

621.385.833 **1008**

A Bibliography of Electron Microscopy. III.—C. Marton & S. Sass. (*J. appl. Phys.*, July 1945, Vol. 16, No. 7, pp. 373–378.) For parts I and II see 545 of 1944 and 165 of 1945.

621.385.833 **1009**

Cinematography with the Universal Electron Microscope.—M. von Ardenne. (*Z. Phys.*, 23rd Feb. 1943, Vol. 120, Nos. 5/6, pp. 397–412.) A further stage in the developments described in 1774 and 1775 of 1942. The equipment enables a cinema film to be taken of a moving or changing subject in an electron microscope, up to 25 pictures a second, or a long series of pictures up to 2 per second using a " Leica-format ". Some photographs are reproduced.

621.385.833 **1010**

The Resolving Power of the Field-Emission [cold cathode] **Electron Microscope.**—E. W. Müller. (*Z. Phys.*, 23rd Feb. 1943, Vol. 120, Nos. 5/6, pp. 270–282.) One limitation on resolving power is the emission-velocity distribution. For a given velocity distribution and a given radius of curvature of the point-cathode, the resolving power can be calculated, and the theory is found to be confirmed by experimental data ; but the highest resolving power so far obtained, about 10 Å, is not limited by these factors, but by non-uniformity of the cathode surface.

621.385.833 **1011**

The Resolving-Power of the Self-Emission Electron Microscope.—A. Recknagel. (*Z. Phys.*, 23rd Feb. 1943, Vol. 120, Nos. 5/6, pp. 331–362.) A homogeneous accelerating field and a perfect electron-lens are assumed, and the resolving power calculated, on the basis of the Schrödinger wave equation, in so far as it is limited by spherical and chromatic aberration and by wave phenomena. The least resolvable distance is of the order of the wavelength at the cathode, decreasing with increase of field strength, but less rapidly than predicted by geometric-optical theory. With further increase of field strength, the electron stream extends more and more beyond the limits of the permissible geometric-optic cone, and there is consequently a theoretical upper limit to the resolving power. For previous work see 514 of 1942.

621.385.833 **1012**

Beam Current Stability in RCA Electron Microscopes.—F. W. Cuckow. (*Rev. sci. Instrum.*, Oct. 1945, Vol. 16, No. 10, p. 293.) Comment on 2306 of 1945 (Crane).

621.398 : 629.13 **1013**

Army Target Plane Controlled by Radio Transmitter.—(*Electronics*, Dec. 1945, Vol. 18, No. 12, p. 300.) A u.h.f. ground transmitter is modulated by five separate audio frequencies selected by a lever simulating the control column of an aircraft. A brief description.

621.9 : 621.38 **1014**

Machine Tool Control.—R. A. Stremel. (*Electronic Industr.*, Nov. 1945, Vol. 4, No. 11, pp. 102–103.) Form and thread milling machine automatically controlled by means of an electronic timer. No further setting required after the first cut. The circuit diagram is given.

623.422.31 : 621.318.572 **1015**

Machine Gun Rate-of-Fire Indicator.—A. D. Peterson. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 134–138.) The reciprocating action of the slide mechanism actuates a micro-switch to initiate pulses which are applied to a series of five Eccles-Jordan trigger circuits with a counting ratio of 16 to 1. The last trigger circuit controls a gate circuit which allows a capacitance to charge for a period of seventeen shots. The final potential across the capacitance is measured by a valve voltmeter calibrated in rates of fire.

623.455 : 621.383 **1016**

Small Arms Ammunition.—R. S. J. Spilsbury & A. Felton. (*Electrician*, 28th Dec. 1945, Vol. 135, No. 3526, pp. 739–743.) Light falling on the base of a metal cartridge case passes through the fire holes to a photocell. A relay mechanism is actuated, causing the case to be accepted or rejected according to the adequacy of the area of the fire holes.

629.13 : 621.317.39 **1017**

Circuit of Electronic Capacitance-Type Fuel Gage.—(*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 324..332.) The fuel rises between two concentric aluminium tubes thus varying their mutual capacitance. The change in capacitance is measured on a self-adjusting bridge. Mass of fuel in the tank is measured, rather than its volume, as thermal expansion of the liquid is offset by a fall in permittivity.

629.13 : 621.317.39 **1018**

Electronic Fuel Gaging.—(*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 234..244.) A 10 kc/s oscillator feeds two similar L-C circuits. One capacitor is pre-set for reference, the other, in the fuel tank, varies in capacitance with the quantity of fuel dielectric present. A meter shows the ratio of amplitudes of oscillation of the two circuits.

629.13 : 621.43.044.1 : 621.3.029.56 **1019**

High-Frequency Aircraft Ignition System.—(*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 264..272.) The magneto output at about 1 200 V is converted into 2–3 Mc/s pulses by an impulse-type frequency converter in each spark plug circuit, and transformed to 10 000 V by a transformer built into the end of the plug. The advantages are enumerated. A short note.

677.024 : 621.383 **1020**

Phototube Weft Straightening in Textile Industry.—(*Electronics*, Nov. 1945, Vol. 18, No. 11, pp. 316..324.) Two spots of light, with associated phototube circuits, explore the fabric in directions symmetrically disposed to the direction of travel of the fabric. When the weft is not at right angles to the warp the impulses from the two channels do not occur at the same frequency, and the frequency difference is used to control the operation of the straightening motor.

615.84 **1021**

Technic of Electrotherapy and Its Physical and Physiological Basis [Book Review].—S. L. Osborne & H. J. Holmquest. Chas. C. Thomas, Springfield, Ill., 1944, 780 pp., $7.50. (*Rev. sci. Instrum.*, Oct. 1945, Vol. 16, No. 10, p. 283.) " From the physicist's point of view it is one of the few works of this kind which furnishes a thoroughly adequate and sound background for the . . .results produced with physical therapy methods . . ."

PROPAGATION OF WAVES

621.3.011.2 + 621.011.5].029.62 : 631.437 **1022**

The Electrical Properties of Soil at Wavelengths of 5 Metres and 2 Metres.—J. S. McPetrie & J. A. Saxton. (*J. Instn elect. Engrs*, Part I, Jan. 1946, Vol. 93, No. 61, p. 58.) Long abstract of 711 of March.

621.396.1 + 621.396.8 **1023**

The Evolution of the Technique of Long-Distance Telecommunications.—Rabuteau. (*See* 1048.)

621.396.11 + 534.231 **1024**

The Saddle-Point Method in the Vicinity of a Pole with Applications to Wave-Optics and Acoustics.—H. Ott. (*Ann. Phys., Lpz.*, 1943, Vol. 43, Nos. 6/7, pp. 393–403.) A study of the integration in the complex plane of expressions of the form $e^{ikR\cos(\theta-\alpha)}A(\theta)\,d\theta$ leading to solutions for the vicinity of a pole in terms of Fresnel integrals. The method is applied to a vertical dipole assumed to be located above the surface of an earth of finite conductivity, and leads to a general formula for the distant field in any direction which includes Sommerfeld's classical formula as a special case. The treatment is considered to throw some new light on the question of the " surface wave ". " The splitting off of a Zenneck-wave term from the total radiation is thus seen to be, in certain conditions, not so arbitrary a matter as has been widely suggested ; this surface wave does not extend far into the atmosphere, but appears, so to speak, as a very narrow fringe [*Saum*] to the wave field."

621.396.11 : 551.51.053.5 : 523.746 **1025**

The Bright New World—of Sunspots.—E. H. Conklin. (*QST*, Jan. 1946, Vol. 30, No. 1, p. 43.) Mainly an account of how world-wide ionospheric research during the war has extended knowledge of the characteristics of long-distance propagation *via* the F layer.

621.396.11 : 551.51.053.5 : 550.38 **1026**

On the Influence of the Terrestrial Magnetic Field on the Reflection of Radio Waves from the Ionosphere.—V. L. Ginsburg. (*J. Phys., U.S.S.R.*, 1943, Vol. 7, No. 6, pp. 289–304.) " The question of the influence of the terrestrial magnetic field on the reflection of radio waves and signals from an inhomogeneous ionized layer (Heaviside layer) is considered [theoretically]. In particular the ropagation of waves at a small angle to the direction of the magnetic field is investigated, and it is shown that in this case a very peculiar splitting of the reflected signal into three pulses, and not into two, as observed in other cases, must take place."

621.396.11 : 741.021 **1027**

Drafting Aids to Relay Profiling.—(*See* 1087.)

621.396.11.029.62 **1028**

Field Intensities Beyond Line of Sight at 45.5 and 91 Mc.—C. W. Carnahan. (*Communications*, Dec. 1945, Vol. 25, No. 12, pp. 46..92.) Tests on a 76-mile link. For equal transmitter power 45.5 Mc/s signals exceeded to 10 μV/m all the time (2 months), while 91 Mc/s signals exceeded this value only 65% of the time. Report of an I.R.E. paper.

621.396.67 + 621.396.11 **1029**

Antenne e propagazione delle onde elettromagnetiche (per ingegner) [Book Review].—Peroni. (*See* 859.)

RECEPTION

621.396.61.029.64 **1030**

Duplex Phone on 5300 Megacycles.—Merchant & Harrison. (*See* 1100.)

621.396.62 **1031**

Pye Model 15A [receiver: test report].—(*Wireless World*, Jan. 1946, Vol. 52, No. 1, pp. 12–13.)

621.396.621.52 **1032**

The Super-Regenerative Detector: an Analytical and Experimental Investigation.—F. R. W. Strafford. (*J. Instn elect. Engrs*, Part III, Jan. 1946, Vol. 93, No. 21, pp. 23–28.) An approximate theoretical analysis on the basis of an exponential build-up of oscillations in the grid circuit. The circuit gives high amplification with inherent a.v.c. action, but with severe distortion for deeply modulated signals. The selectivity of the input circuit is dependent on the frequency and waveform of the quenching voltage. A low quenching frequency with a waveform giving a slow rate of rise (*e.g.* sinusoidal) gives optimum selectivity and signal to noise ratio. On the other hand the output at modulation frequency rises with increase in quenching frequency. Impulsive interference may be substantially suppressed. F.m. reception is discussed briefly.

621.396.621.53 : 621.385.2 **1033**

Diode Input Resistance.—R. E. Burgess. (*Wireless Engr*, Jan. 1946, Vol. 23, No. 268, p. 29.) Letter pointing out computational errors in 3343 of 1941 (Bell).

621.396.622 : 621.396.619.018.41 **1034**

A New F.M. Detector Circuit [requiring no limiter].—G.G. (*QST*, Jan. 1946, Vol. 30, No. 1, pp. 26–27.) See 574 of March.

621.396.645 : 621.317.33 **1035**

Measurement of Amplifier Input Impedance.—Waidelich. (*See* 970.)

621.396.82 : 523.5 **1036**

Listening in on the Stars.—Villard. (*See* 916.)

621.396.822 **1037**

A Theory of Valve and Circuit Noise.—N. R. Campbell & V. J. Francis. (*J. Instn elect. Engrs*, Part III, Jan. 1946, Vol. 93, No. 21, pp. 45–52.) Detailed discussion of fluctuation noise on the basis of Campbell's theorem, emphasis being laid on the rigour of the fundamental postulates in the statistical theory of random processes. Campbell's theorem is applied to the shot noise in a tuned circuit connected to a temperature-limited diode and to thermal noise after reference to the equipartition principle leading to Johnson's formula. A general theory of valve and circuit noise in complicated systems is presented using a determinant method. The modification of the theory for the effects of space charge is based on the treatment of Thompson and North. The effects of finite transit time in a valve and in a resistor are discussed, and doubt expressed regarding Spenke's assertion that Johnson's formula holds at very high frequencies.

621.396.822 **1038**

[Noise] **Fluctuations of Electric Current.**—D. A. Bell. (*J. Instn elect. Engrs*, Part III, Jan. 1946, Vol. 93, No. 21, pp. 37–44.) A theoretical review of shot noise and thermal noise. The thermodynamical basis of Nyquist's theorem and Schottky's formula for the temperature-limited diode are briefly discussed. The controversial case of the space-charge-limited diode is considered in detail, the mutually consistent theories of Rack, Spenke and North being contrasted with that of Bell which predicts appreciably higher values for the space-charge reduction factor F^2 at large values of $eV/k\theta$. A suggestion by J. R. Pierce reconciling the two theories is not accepted by the author. Negative-grid triodes, screen-grid valves (with partition noise), secondary-emission amplifiers, receiver noise figures, and the noise in an aerial are considered briefly.

621.396.822 **1039**

Fluctuation Voltages in Receiver Input Circuits.—J. R. Ragazzini. (*Proc. Radio Cl. Amer.*, Dec. 1945, Vol. 22, No. 2.) Noise due to thermal agitation of electrons. The analogy with Brownian movement is used to develop equations for noise voltages. If valve noise is negligible compared with circuit noise in a receiver, signal to noise ratio can be improved by overcoupling.

621.396.822 : 621.317.34 : 621.317.72 : 621.385 **1040**

The Rectification of Signal and Noise.—Francis & James. (*See* 971.)

621.396.826 : 621.396.619.018.41 **1041**

Frequency-Modulation Distortion Caused by Multipath Transmission.—M. S. Corrington. (*Proc. Inst. Radio Engrs*, Dec. 1945, Vol. 33, No. 12, pp. 878–891.) A theoretical and experimental study. When the amplitude of the direct and reflected waves are about equal at the receiver, interference at certain frequencies may cause one or more "holes" in the carrier too deep for the limiter to deal with, giving rise to unwanted amplitude variations at the discriminator. At these points there is also a very rapid phase shift causing large peaks or dips in the discriminator output. The distortion increases with the deviation and path difference, and is worse on the higher audio frequencies. Expressions for the distorted waveform are derived, and observed waveforms are shown.

621.397.62 **1042**

Extended-Range Television Reception: Part II.—Wilder. (*See* 1093.)

1043

Correction.—In 410 of February (Frank), *for* Vol. 35 *read* Vol. 34.

STATIONS AND COMMUNICATION SYSTEMS

621.3(41) "1939/1945" **1044**
"British Electrical Engineers and the Second World War".—P. Dunsheath. (*J. Instn elect. Engrs.*, Part I, Jan. 1946, Vol. 93, No. 61, pp. 17–27.) The full paper, of which summaries were noticed in 415 of February and 729 of March.

621.391.32 : 621.395.44 : 622.33 **1045**
The Employment in Mines of Telephony through the Ground.—Burgholz. (*Génie civ.*, 1st/15th Nov. 1944, Vol. 121, Nos. 21/22, p. 180.) Short abstract of a paper in *Glückauf*, 29th Apr. 1944. The use of an l.f. carrier current is recommended.

621.395.44 **1046**
Design of Carrier-on-Cable Equipment.—T. S. Skillman. (*Communication Rev.*, 1945, Vol. 1, No. 1, pp. 1–24.) Design aspects of multi-channel equipment for use on balanced multi-pair telephone paper-insulated cables are discussed. A description is given of a seventeen-channel system operating with such cables using the standardized frequency spacings.

621.396/.397 + 621.365.5 + 621.385 **1047**
Results Achieved by a Large [French] **Industrial Research Centre** [Le Groupe Industriel des Compagnies Françaises de T.S.F. Associées] **During and Despite the Occupation.**—Brenot. (*See* 1105.)

621.396.1 + 621.396.8 **1048**
The Evolution of the Technique of Long-Distance Telecommunications.—M. G. Rabuteau. (*Onde élect.*, Dec. 1945, Vols. 20/25, No. 225, pp. 140–154.) A survey in anticipation of forthcoming international discussion. The potentialities of the various frequency bands are classified thus :—(1) 10 kc/s to 150 kc/s—stable long-distance communication by high-power installations : (2) 150 kc/s to 3 Mc/s—short and medium distances : (3) 3 Mc/s to 30 Mc/s—ionospheric propagation, subject to diurnal and seasonal effects : 3 Mc/s to 6 Mc/s—short distances, by day : 6 Mc/s to 9 Mc/s—long distances, by night : 9 Mc/s to 15 Mc/s—day-night "transition" frequencies for long distances : 15 Mc/s to 30 Mc/s—long distances by day. "In general, to assure optimum conditions for medium and long distances by day and by night, three frequencies are necessary, one for day, a higher frequency for night, and an intermediate frequency." (4) 30 Mc/s to 300 Mc/s—optical ranges : (5) above 300 Mc/s—not yet used for long-distance telecommunication, but likely to be used for optical-range relay links. The propagation characteristics of these bands are illustrated by numerous graphs and diagrams.

Possible means of increasing the traffic-carrying capacity of available bands include :—(1) Stabilization of carrier frequencies : (2) minimization of transmitted bandwidth (*e.g.*, single sideband working), use of multiplex systems, based on pulse or frequency modulation : (3) elimination of parasitic radiation (carrier harmonics) : (4) use of highly directive systems, enabling many different routes to operate on the same frequency.

621.396.619.018.41 **1049**
FM for Ham Use.—R. Frank. (*Radio News*, Dec. 1945, Vol. 34, No. 6, pp. 44–45.) Transmitter amplifiers can be run with larger inputs than for a.m., and modulation is carried out at low level. Reactance-tube modulation is recommended with a maximum modulation frequency of 2 500 c/s and deviation ratio of unity.

621.396.619.018.41 **1050**
Frequency Modulation.—R. Schulz. (*Funktech. Mh.*, July/Aug. & Sept./Oct. 1943, Nos. 7/8 & 9/10, pp. 84–88 & 100–102.) A review of the properties and advantages of f.m. compared with other systems, particularly a.m., and an account of basic f.m. circuits.

621.396.619.018.41 **1051**
Frequency Modulation.—K. R. Sturley. (*J. Instn elect. Engrs*, Part III, Jan. 1946, Vol. 93, No. 21, pp. 11–15.) Discussion of 4047 of 1945.

621.396.619.018.41 : 621.396.826 **1052**
Frequency-Modulation Distortion Caused by Multipath Transmission.—Corrington. (*See* 1041.)

621.396.619.16 **1053**
Pulse Modulation.—D. Cooke. (*Wireless Engr*, Jan. 1946, Vol. 23, No. 268, p. 29.) A plea for early rationalization and standardization of nomenclature applied to various simplex and multiplex pulse-modulation communication systems. Some of the terms used in 183 of January (Roberts & Simmonds) are considered suitable but "pulse delay modulation" is considered inapt. "Pulse phase modulation" is suggested as an alternative.

621.396.619.16 : 621.397.5 **1054**
Pulse Modulation.—Bedford. (*See* 1092.)

621.396.65.029.64 **1055**
Microwave Radio Relay to Replace Telegraph Lines.—(*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 300..308.) The relay systems include towers about 30 miles apart with four paraboloid aerials, two transmitting in opposite directions and two receiving from opposite directions. The operating frequency is about 4 000 Mc/s with a bandwidth of 150 kc/s, sufficient for 270 multiplex or 1 080 single telegraph circuits, or 25 ordinary telephone circuits. The stations are automatic and unattended. A brief description.

621.396.65.029.64 : 621.396.619.16 **1056**
AN/TRC-6 – A Microwave Relay System.—H. S. Black. (*Bell Lab. Rec.*, Dec. 1945, Vol. 23, No. 12, pp. 457–463.) Eight speech channels are provided with pulse-position modulation on a frequency of 5 000 Mc/s, which is relatively free from interference. A 57-inch-diameter paraboloid reflector gives a narrow beam of radiation, so that a transmitter power of two watts gives adequate signal strength at the receiver over an optical path of 100 miles. The antenna system is carried on a 50 ft tower. Relay stations have provided communication over a distance of 1800 miles. The equipment was used for Army communications to rear areas on the Western Front with conspicuous success. See also 740 and 741 of March.

621.396.71 + 621.396.677.2 **1057**
Stepping up from ¼ KW to 5 KW [and the use of a directional aerial].—A. E. Griffiths. (*Communications*, Dec. 1945, Vol. 25, No. 12, pp. 33..85.) The conversion of broadcast station KOTA (1 380 kc/s) to the use of higher power and a directional antenna system is described, with particular reference to the phasing and feeding of the three

transmitting towers to give the required field-strength polar diagrams.

621.396.721 **1058**

Station Design and Planning: Part I.—W. H. Allen. (*R.S.G.B. Bull.*, Dec. 1945, Vol. 21, No. 6, pp. 88–89.) Seeks to answer the question "What apparatus shall I require?" for the amateur transmitter. The items detailed are:—aerial; transmitter; receiver; test and maintenance equipment.

621.396.82 **1059**

Radio Counter Measures.—(*Wireless World*, Jan. 1946, Vol. 52, No. 1, p. 18.) A very short account of methods used to confuse enemy communications and radar.

621.396.82 **1060**

QRM – The Electronic Life Saver: Part I.—P. Robbiano. (*QST*, Jan. 1946, Vol. 30, No. 1, pp. 12–18.) An outline of some of the radio-counter-measures work of the U.S.A. Descriptions are given of jamming transmitters developed in the frequency range up to 3 000 Mc/s: one of these is the "Resnatron" which develops about 50 kW (average power) in the frequency range 480–600 Mc/s. The application of noise modulation to jamming transmitters is discussed, and brief mention is made of the use of "window" as a passive device for interfering with enemy radar equipments.

621.396.82 : 621.396.9 **1061**

Radar Countermeasures.—R. G. Peters. (*Communications*, Dec. 1945, Vol. 25, No. 12, pp. 50..93.) Description of land-based and airborne methods of locating and jamming enemy radar stations, with tabulated data on jamming transmitters and searching receivers.

621.396.931 : 625.1 **1062**

Milestones in Railroad [radio] **Communications.**—H. H. Hasselbacher. (*Telegr. Teleph. Age*, Nov. 1945, Vol. 63, No. 11, pp. 22..38.) An historical account of the special requirements. The F.C.C. have reserved 60 channels of 60 kc/s bandwidth in the frequency range 152 to 162 Mc/s. An experimental system using top-loaded mobile aerials has realized full operational expectations.

621.396.931 : 625.1 **1063**

Railroad Radio Communications.—R. A. Clark, Jr. (*Communications*, Dec. 1945, Vol. 25, No. 12, pp. 62..66.) Terminal operations require ranges of a few miles, main line operations require ranges of up to hundreds of miles. Inductive carrier systems using from about 50 kc/s to 200 kc/s can be used for both types of operation. Frequencies of 30 to 2 000 Mc/s have been used for terminal operation.

621.396.97 : 534.76 **1064**

Binaural Stereophonic System of the [French] **State Broadcasting Department.**—J. Cordonnier. (*Génie civ.*, 1st July 1944, Vol. 121, No. 13, p. 105.) A short account of the demonstration of a system, duplicate throughout, with double transmitters and receivers. Transmission was by cable for the demonstration.

SUBSIDIARY APPARATUS

533.5 **1065**

The Hydrogen Gauge—An Ultra Sensitive Device for Location of Air Leaks in Vacuum-Device Envelopes.—Nelson. (*See* 936.)

535.81 : 679.5 : 621.397.62 **1066**

Molded "Lucite" Lens.—(*See* 1095.)

620.199.1/.9 **1067**

Interference-Free Weatherometer [accelerated weathering tester].—Agnew. (*See* 943.)

621.3.083.7 **1068**

Selsyn Indicating Systems for Remote Readings.—F. Wisk. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 276..296.) Explanation of the basic principles.

621.314.2 **1069**

Small Mains Transformers: Suggestions for Preferred Types of Standard Size.—L. A. Sherwood. (*Wireless World*, Jan. 1946, Vol. 52, No. 1, pp. 30–31.) The design of transformers for 10 to 1 000 W could be limited to 7 types of laminations with one bobbin size for each type of laminations.

621.314.2 : 621.396.674 **1070**

Loop-Antenna Coupling-Transformer Design.—Bachmann. (*See* 856.)

621.314.632 : 546.289 **1071**

Germanium Rectifiers.—(*See* 944.)

621.314.65 : 621.396.71 **1072**

The Application of High-Voltage Steel-Tank Mercury-Arc Rectifiers to Broadcast Transmitters.—P. A. T. Bevan. (*J. Instn elect. Engrs*, Part I, Jan. 1946, Vol. 93, No. 61, p. 53.) Long abstract of 206 of January.

621.314.65 : 621.396.71 **1073**

High-Voltage Steel-Tank Mercury-Arc Rectifier Equipments for Radio Transmitters.—J. C. Read. (*J. Instn elect. Engrs*, Part I, Jan. 1946, Vol. 93, No. 61, pp. 54–55.) Long abstract of 205 of January.

621.315.626 + 533.5 **1074**

Ferranti Vacuum-Seal Bushing.—(*Beama J.*, Jan. 1946, Vol. 53, No. 103, p. 28.) A brief description of a glass insulator, bonded to a copper flange and end cap that can be soft soldered. The insulator is rated for 1 000 V r.m.s. a.c. or 1 000 V d.c. working.

621.316.722.078.3 : 621.392.5 **1075**

The Theory of the Non-Linear Bridge Circuit as Applied to Voltage Stabilizers.—Patchett. (*See* 867.)

621.316.722.078.3 : 621.396.682 **1076**

Voltage-Regulated Power Supplies: Part II.—G. E. Hamilton & T. Maiman. (*Communications*, Dec. 1945, Vol. 25, No. 12, pp. 70–71.) Typical design data are given. A diagram of a power unit is given for: 0–500 V output, ranges 0–10, 0–50, 0–100 and 0–500 V, maximum output current 300 mA, regulation better than 1% over the whole voltage range, ripple voltage 10 mV. For part I see 756 of March.

621.316.974 : 621.318.4.017.31 **1077**

Power Loss in Electromagnetic Screens.—C. F. Davidson, R. C. Looser & J. C. Simmonds. (*Wireless Engr*, Jan. 1946, Vol. 23, No. 268, pp. 8–15.) An empirical investigation of plane screens formed of concentric circular loops of wire shows that for efficiency of screening the screen must be made large enough for the eddy currents in the outer rings to be not greater than about one-tenth of the current in the loops carrying maximum eddy current. When the screen is between two small inductance coils, maximum eddy current occurs in those loops having a diameter of the same order as that of the inducing coil. The power loss occurs chiefly in these loops, and can be minimized by employing heavier conductors for their construction. Fair agreement is obtained between measured values of the increase of the resistance of screened coils and values deduced on the assumption that the eddy current distribution will approximate to that in a continuous sheet.

621.317.33 : 621.396.611.21 **1078**

The Measurement of the Activity of Quartz Oscillator Crystals.—Biggs & Wells. (*See* 969.)

621.317.755 **1079**

A Small Oscilloscope Using the 913.—E. M. McCormick. (*QST*, Jan. 1946, Vol. 30, No. 1, pp. 32–34.) A simple oscilloscope in which the use of a high-voltage transformer is avoided by using 6H6 valves directly connected to the 115 V a.c. supply in voltage doubling circuits. The instrument is not suitable for use at video frequency. Diameter of tube 1 inch, maximum sensitivity (with amplifier) about 1 inch/V.

621.317.755 **1080**

An Introduction to the High-Voltage Cathode-Ray Oscillograph.—J. B. Higham. (*J. Instn elect. Engrs*, Part I, Jan. 1946, Vol. 93, No. 61, pp. 51–52.) Summarizes the features of the modern high-speed oscilloscope. A cold cathode is usual, but electron guns employing thermionic emission are foreseen. Summary of an I.E.E. Students' Section Chairman's address.

621.318.323.2.029.5 **1081**

Iron Powder Cores and Coils.—H. W. Jaderholm. (*Proc. Inst. Radio Engrs*, Dec. 1945, Vol. 33, No. 12, p. 904.) The apparent permeability of a short cylindrical core is expressed in terms of the true (or "ring") permeability and the ratio of core length to diameter. The formulae of Bozorth and Chapin are used (*J. appl. Phys.*, May 1942, Vol. 13, No. 5, pp. 320–326.).

621.318.4.013.22 **1082**

Coil Systems for Producing Transverse and Longitudinal Magnetic Gradients.—G. H. Shortley & A. May. (*J. appl. Phys.*, Dec. 1945, Vol. 16, No. 12, pp. 841–843.) "A coil system is described which produces very constant magnetic gradients throughout a considerable part of the volume occupied by the coil assembly. One modification produces constant transverse and longitudinal gradients of the field transverse to a long cylindrical region; another modification produces constant transverse and longitudinal gradients of the magnetic field throughout a spherical volume. Gradient data are given for both modifications."

621.384.6 (091) **1083**

Historical Development of the Betatron.—D. W. Kerst. (*Nature, Lond.*, 26th Jan. 1946, Vol. 157, No. 3978, pp. 90–95.)

621.396[.65 + .71 + .812.3 **1084**

"Recent Developments in Communication Engineering".—A. H. Mumford. (*J. Instn elect. Engrs*, Part I, Jan. 1946, Vol. 93, No. 61, pp. 41–50.) The full paper, of which a summary was noticed in 4046 of 1945. Reprinted in *J. Instn elect. Engrs*, Part III, Jan. 1946, Vol. 93, No. 21, pp. 2–11.

621.396.662.2 **1085**

On the Theory of the Progressive Universal Winding.—A. W. Simon. (*Proc. Inst. Radio Engrs*, Dec. 1945, Vol. 33, No. 12, pp. 868–871.) An extension of previously developed theory (1348 of 1937 and 1464 of 1945 – Simon) to progressive universal winding, with an exact formula for calculating the gear ratio to be used. "The theory of the spiral ridges and close-packed layers of progressive universal coils is developed, and formulas giving the slope of the spiral ridge and the dimensions of the close-packed layers are deduced. The principles underlying the selection of the optimum number of cross-overs per turn are discussed, and an example of the application of the formulas to the design of a progressive universal coil is given."

621.396.69 + 621.38 **1086**

The Physical Society's Exhibition.—(*See* 1131/1133.)

741.021 : 621.396.11 **1087**

Drafting Aids to Relay Profiling.—F. J. Bingley. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 316..320.) Plotting of profiles of terrain along a line-of-sight television path is facilitated by the use of a special T-square with cross-members calibrated in height units. Modifications may be introduced to allow for the curvature of the earth and refraction of waves in the atmosphere.

TELEVISION AND PHOTOTELEGRAPHY

621.383 : 621.385.15 : 621.314.2 : 535.24 **1088**

The Possibility of Comparing Unmodulated Luminous Fluxes by means of an Electron-Multiplier Photocell followed by an A.C. Amplifier.—L. Le Blan. (*C. R. Acad. Sci., Paris*, 19th March 1945, Vol. 220, No. 12, pp. 394–396.) Constant sine-wave modulation is applied to one of the electrodes of the electron multiplier. The operating point is selected so that the modulation of the electron current is mainly at the second harmonic of the modulating voltage, so that by tuning the amplifier to this second harmonic the effect of capacitance coupling of the modulating voltage to the amplifier at fundamental frequency is suppressed.

621.397.2 **1089**

Comments on Existing Television Systems from a Measurement Viewpoint.—J. Minter. (*Communications*, Dec. 1945, Vol. 25, No. 12, pp. 47..80.) Proposals are made for changing the standard receiver selectivity characteristics to simplify alignment. The type of receiver alignment used prior to 1941 gives less trouble due to phase shift than that in use now. Report of an I.R.E. paper.

621.397.3 **1090**

A Simple Optical Method for the Synthesis and Evaluation of Television Images.—R. E. Graham & F. W. Reynolds. (*Waves and Electrons*, Jan. 1946, Vol. 1, No. 1, pp. 18–30.) An optical method of simulating television picture reproduction is described, using an out-of-focus 35 mm motion-picture projector and a lined graticule placed in front of the receiving screen. A theoretical analysis is given of the appearance of the resulting image and its dependence on various factors such as degree of defocusing of the image, shape of projector aperture, and characteristics of the line screen. The results are compared with those of television image analysis, and shown to be in close agreement. Photographs of simulated television pictures are given, which illustrate the spurious effects introduced by the scanning process.

621.397.3 **1091**

Television Resolution as a Function of Line Structures.—M. Cawein. (*Proc. Inst. Radio Engrs*, Dec. 1945, Vol. 33, No. 12, pp. 855–864.) Theoretical discussion of the distortion of recurrent rectangular impulses by transmission through finite apertures in an optical system. The Fourier integral representation is used to evaluate the effect of a finite cut-off frequency, and the response obtained by the synthesis of harmonics is expressed to a close approximation in terms of the sine integral. The widening of a pulse undergoing a number of aperture processes is evaluated. The results are applied to explaining the relative merits of 16 and 35 mm film for television image transmission.

621.397.5 : 621.396.619.16 **1092**

Pulse Modulation.—L. H. Bedford. (*Wireless Engr*, Feb. 1946, Vol. 23, No. 269, pp. 56–57.) In the "videosonic" television system (see 230 of January) the sound is conveyed by width-modulated pulses. It is clear: "(*a*) That there is an absolute limit for the audio band at half the strobe frequency, (*b*) That restriction to this band must be carried out by filtering both at the transmitter and at the receiver, and (*c*) That the linear superposition principle applies so that no complications arise on considering complex wave forms." For the present 405-line standard "one may anticipate an audio-frequency band of perhaps 4 000 c/s, which seems rather a severe restriction . . ."

621.397.62 **1093**

Extended-Range Television Reception : Part II.—M. P. Wilder. (*QST*, Jan. 1946, Vol. 30, No. 1, pp. 35–40, 102.) Design and construction of the signal-, intermediate-, and video-frequency portions of a sensitive television receiver. The signal-frequency amplifier is operated at a distance from the rest of the receiver to minimize interference. A filter is incorporated in the transmission line to the mixer with the object of eliminating further interference from powerful transmissions in the 7–13 Mc/s band. For part I see 463 of February.

621.397.62 **1094**

The DC Restorer : Its Uses in Television and Radar.—(*Wireless World*, Jan. 1946, Vol. 52, No. 1, pp. 8–11.) A descriptive article.

621.397.62 : 535.81 : 679.5 **1095**

Molded "Lucite" Lens.—(*Rev. sci. Instrum.*, Oct. 1945, Vol. 16, No. 10, p. 298.) Note on moulded aspherical lenses for correcting spherical aberration in television projection. A product of E. I. DuPont de Nemours & Co.

621.397.813 **1096**

Theoretical Investigation of the Distortion of Television Signals in Valve Circuits.—Huber. (*See* 901.)

621.397 + 654.17 **1097**

Television To-day and To-morrow [Book Review].—L. de Forest. Hutchinson's Scientific and Technical Publications, London, 1945, 176 pp., 16s. (*Electronic Engng*, Feb. 1946, Vol. 18, No. 216, p. 62.) "The whole book is infused with a tremendous rising tempo of enthusiasm . . ."

TRANSMISSION

621.385.032.442 : 621.3.025.4 **1098**

Polyphase from Single Phase for Valve Supply Circuits.—E. M. I. Laboratories. (*See* 863.)

621.396.61 : 621.396.662 **1099**

A Radio-Frequency Auto-Resonator.—J. F. Clemens. (*QST*, Jan. 1946, Vol. 30, No. 1, pp. 65–66.) An arrangement for automatically tuning the amplifier stage of a transmitter from a remote point. It comprises a motor-driven tank capacitor, in parallel with which is a small capacitor varied cyclically at 114 c/s. When the stage is correctly in tune there is a 228 c/s component in the anode current of the amplifier ; when not in tune there is a 114 c/s component. The appearance of the 228 c/s voltage is used to stop the motor driving the tank capacitor.

621.396.61.029.64 **1100**

Duplex Phone on 5300 Megacycles.—R. Merchant & A. E. Harrison. (*QST*, Jan. 1946, Vol. 30, No. 1, pp. 19–24.) A description of a simple transmitter-receiver, using reflector frequency-modulation of the 2K43 reflection klystron. Separate parabolic mirrors are used for transmitting and receiving. Two stations of this type have achieved reliable communication over an optical path about 5 miles in length.

621.396.612.1.029.64 **1101**

Micro-Electromagnetic Waves.—M. G. Kelliher & E. T. S. Walton. (*Wireless Engr*, Feb. 1946, Vol. 23, No. 269, pp. 46–51.) A description of a low-power spark oscillator operating on centimetre wavelengths, and a tunable detector with associated amplifier suitable for examining the properties of the radiation. Experiments are described showing that some twenty to thirty wavetrains are emitted during each half of the spark repetition period. Each wavetrain is shown to comprise at least thirty oscillations : the reason for this low value of damping coefficient is discussed. The energy spectrum from the oscillator is analysed experimentally ; the peak wavelength is found to be 2.7 times the total length of the dipole across which sparking occurs. This is rather higher than the theoretical factor, the discrepancy being attributed to self-capacitance associated with the oscillatory dipole.

621.396[.65 + .71 + .812.3 **1102**

"Recent Developments in Communication Engineering".—A. H. Mumford. (*J. Instn elect. Engrs*, Part I, Jan. 1946, Vol. 93, No. 61, pp. 41–50.) The full paper, of which a summary was noticed in 4046 of 1945. Reprinted in *J. Instn elect. Engrs*, Part III, Jan. 1946, Vol. 93, No. 21, pp. 2–11.

VALVES AND THERMIONICS

537.52 **1103**

On the Mechanism of Spark Formation.—Teszner. (*See* 909.)

537.523.2 **1104**

On the Velocity-Distribution of Electrons in [cold-cathode] **Field Emission.**—E. W. Müller. (*Z. Phys.*, 23rd Feb. 1943, Vol. 120, Nos. 5/6, pp. 261–269.) Recent work (see Haefer, 1680 of 1941) has shown good confirmation of the wave-mechanics theory of field emission as given by Sommerfeld, Bethe and Nordheim, in respect of current density, but is less satisfactory in respect of velocity distribution. This is attributed to defects in the methods of measurement used hitherto. The paper describes an investigation based on the use of retarding potentials, in which the previous sources of error have been eliminated. It is shown that the velocity distribution curve has the expected half-value width of 0.4 V, and that the distribution is independent of direction relative to crystal orientation.

621.385 + 621.396/.397 + 621.365.5 **1105**

Results Achieved by a Large [French] **Industrial Research Centre** [Le Groupe Industriel des Compagnies Françaises de T.S.F. Associées] **During and Despite the Occupation.**—P. Brenot. (*Onde élect.*, Sept. 1945, Vol. 25, No. 222, pp. 29–46.) Work on valves included preparation of the following types (*a*) E3056, 300 kW class C amplifier for medium waves, (*b*) television tetrodes, two working as class B amplifiers give 40 kW at 4½ m wavelength, (*c*) a water-cooled 25 kW pentode, (*d*) an air-cooled 7 kW pentode, (*e*) a series of 10 glass-based pentodes, 5 single, 5 double, for wavelengths between 60 cm and 6 m, and power between 2 W and 1 300 W, (*f*) v.m. tubes giving 250–300 W c.w. at 15 and 20 cm wavelengths, (*g*) v.m. tubes nearly ready are for 20–30 cm wavelengths giving 10 kW c.w. and a few hundred kW pulsed peak power, (*h*) v.m. amplifiers giving 250–300 W c.w. at 15–25 cm, (*i*) magnetrons for wavelengths between 10 and 20 cm giving about 100 kW pulsed peak power at 10 cm with 40% efficiency.

Work on multiplex radio communications was carried out at various wavelengths of which the shortest was in the range 21–24 cm. For the latter a 350 W klystron was developed in 1941. The advantages of f.m. and pulse modulation for multiplex systems were investigated with metre and decimetre waves. For decimetre systems relay stations were made to receive and transmit at slightly different wavelengths.

Other work with metre and decimetre waves included investigation of the properties of waveguides and horns, the development of a radar obstacle-locating system, and of a landing beacon system.

Work was also done on television (including the use of 20 cm klystron amplifiers for single-sideband modulation), electron microscope, a 13 and 50 m broadcasting station, telegraph receivers, undulators, goniometers, and an industrial plant for the surface hardening of steel by 500 kc/s induction heating.

621.385.032.22 **1106**

Effect of Surface Finish and Wall Thickness on the Operating Temperature of Graphite Radio-Tube Anodes.—L. L. Winter & H. G. MacPherson. (*Proc. Inst. Radio Engrs*, Dec. 1945, Vol. 33, No. 12, pp. 834–837.) Experimental investigation of the effect on internal and external temperatures of cylindrical graphite anodes by brightness measurements at 6 530 Å using an optical pyrometer. The emissivity is calculated from the temperature difference: it is 0.89 for a sanded surface and 0.82 for a polished surface. It is concluded that temperature differences not greater than 30° C will occur in radio valve anodes operating at about 1 000° C as a result of differences in surface finish and wall thickness of 0.07–0.1 inch.

621.385.1 : 621.396.611.4 **1107**

Frequency Stabilisation of Resonators Influenced by Electron Discharge.—E.M.I. Laboratories. (*Electronic Engng*, Feb. 1946, Vol. 18, No. 216, p. 61.) Variation of the electron beam may cause frequency variation or detuning of the resonator of a v.m. valve. This difficulty can be surmounted by using a second electron discharge which can be varied so as to modify the unwanted changes in the main beam. Application to a reflection type klystron is described.

621.385.2/.3].012.8 **1108**

Triode Equivalent Circuits.—Bell. (*See* 864.)

621.385.3/.8 **1109**

On the Theory of the Passage of an Electron Current Through Triodes and Multielectrode Tubes and on the Notion of Control Voltage in the Presence of Space Charge.—G. A. Grünberg. (*J. Phys., U.S.S.R.*, 1943, Vol. 7, No. 6, pp. 279–285.) ". . . a method for the approximate calculation of the current passing through a triode is given, under the condition that the current in the tube is limited by a space charge. It is shown that this method leads automatically to the introduction of the notion of a control voltage, giving at the same time the limits of validity of this notion, starting from a consideration of the processes in the tube in the presence of a space charge. The value ϕ_{st} of the control voltage turns out to be somewhat different from the expression $\phi_{st} = (\phi_g + D\phi_a)/(1 + D)$, which corresponds to the usual formula of van der Bijl-Barkhausen-Schottky, and in the case of a cylindrical triode is approximately equal to $\phi_{st} = (\phi_g + D\phi_a)/[1 + D(r_a/r_g)^{\frac{2}{3}}]$ (r_a and r_g are the radii of the anode and of the grid, D—the usual "static" permeability of the tube). It is shown that this difference is of an essential character, and that in the case of grids with sufficiently thin wires a formula of the type $\phi_{st} = (\phi_g + D\phi_a)/[1 + D(r_a/r_g)^{\frac{2}{3}}]$ is the only possible, inasmuch as the control voltage, linearly depending on grid and plate potentials, actually exists. Similar results are obtained for plane triodes. At the end of the paper the method is applied to the determination of the current passing through a cylindrical diode; the comparison of the result obtained with Langmuir's exact solution enables one to estimate the error introduced by the approximate character of the method."

621.385.3 **1110**

Transmitter Valves – II.—M. Matricon, J. Chantereau, R. Montagne & A. Laurent. (*Onde élect.*, Dec. 1945, Vols. 20/25, No. 225, pp. 155–167.) In two sections: (*a*) The control of materials in valve manufacture. The maintenance of a high standard of uniformity and reliability in valve manufacture requires a routine of precise control of the materials employed. The methods used by the French Thomson-Houston Company include ordinary quantitative chemical analysis of metals and alloys, spectrographic tests of pure metals, mechanical tests on metals, micro-metallography, and X-ray diffraction for the study of the crystalline condition. (*b*) Demountable continuously-evacuated valves. A detailed illustrated description of demountable valves in metal and fused silica, particularly for short wavelengths. Output powers range from 120 to 145 kW for wavelengths 16 to 49 metres. For part I of this paper see 490 of February.

621.385.832.032.29 **1111**

High-Frequency Deflection System.—G. Rudenberg. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 332..340.) Summary of 3026 of 1945.

621.385.833 **1112**

Electron Beams in Strong Magnetic Fields.—J. R. Pierce. (*Phys. Rev.*, 1st/15th Nov. 1945, Vol. 68, Nos. 9/10, pp. 229–230.) A mathematical note dealing with the form of the electron beam emitted from a circular disk cathode in the presence of a strong uniform magnetic field applied in a direction normal to the cathode.

621.396.822 **1113**

A Theory of Valve and Circuit Noise.—Campbell & Francis. (*See* 1037.)

621.396.822 **1114**

[Noise] **Fluctuations of Electric Current.**—Bell. (*See* 1038.)

621.385 **1115**

Radio Valve Vade Mecum, 1945 [Book Review].—P. H. Brans. Algemeene en Technische Boekhandel, Antwerp. (*Wireless Engr*, Jan. 1946, Vol. 23, No. 268, p. 15.) Gives in Flemish, French, English and German, characteristics and base connexions of many British, U.S., and Continental (including Russian) valves.

MISCELLANEOUS

001.83 **1116**

International Scientific Co-Operation.—F. J. M. Stratton. (*Nature, Lond.*, 26th Jan. 1946, Vol. 157, No. 3978, pp. 96–98.) An account of the organization and activities of the International Council of Scientific Unions, and of the recent meeting of its Executive Committee.

001.89 : 359 **1117**

The Engineer's Place in Naval Research.—W. G. Schindler. (*Proc. Inst. Radio Engrs*, Dec. 1945, Vol. 33, No. 12, pp. 823–824.) Review of organization of technical research for the U.S. Navy in both government and industrial laboratories.

001.891 **1118**

Scientific Research and Industrial Planning: British Association Conference.—(*Nature, Lond.*, 5th Jan. 1946, Vol. 157, No. 3975, pp. 8–11.) The conference lasted two days and many speakers eminent in the scientific world took part. "The general theme . . . was essentially the human element in research: the research worker himself and the conditions which are most likely to stimulate creative work; the place of the human factor in production and the contribution which scientific research can render to efficiency." At the end a resolution was passed approving the statement of President Truman, Mr. Attlee and Mr. MacKenzie King on atomic energy.

001.92 : [5 + 6 **1119**

Science and the Public.—(*Nature, Lond.*, 26th Jan. 1946, Vol. 157, No. 3978, pp. 110–111.) Report of a Royal Institute of Chemistry discussion on "The Publicity of Science, with particular reference to Chemistry", covering the press, exhibitions, films and broadcasting.

06.054 **1120**

The Presentation of Technical Developments Before Professional Societies.—W. L. Everitt. (*Proc. Instn Radio Engrs, Aust.*, Sept 1945, Vol. 6, No. 3, pp. 15–17.) Reprint of 497 of February.

06.055 **1121**

Preparation and Publication of I.R.E. Papers.—H. M. Stote. (*Waves and Electrons*, Jan. 1946, Vol. 1, No. 1, pp. 5–9.) Description of the Editorial Department's method of dealing with papers for publication in *Proc. Inst. Radio Engrs, N.Y.*, and in *Waves and Electrons*, with advice to authors on their preparation.

061.22 : 621.396 (054) **1122**

Waves and Electrons.—A new monthly publication of the Institute of Radio Engineers, bound together with the monthly parts of *Proc. Inst. Radio Engrs, N.Y.*, intended to contain papers on the engineering development of radio and electronic equipment, tutorial and historical papers, etc.

061.3 : 621.396] (7/8) **1123**

The Inter-American Radio Conference of Rio.—A. L. Budlong. (*QST*, Dec. 1945, Vol. 29, No. 12, pp. 33–35.) The principal objective of the third Inter-American Radio Conference, held in Rio de Janeiro, September, 1945, was to rewrite the Habana Convention and to revise the organization of the Inter-American Radio Office.

6(07) **1124**

A Reply From Industry to the Colleges.—M. M. Boring, A. R. Stevenson, Jr., & K. B. McEachron, Jr. (*Elect. Engng, N.Y.*, Nov. 1945, Vol. 64, No. 11, pp. 398–400.) A discussion on the future curricula of U.S. engineering colleges, suggesting that war-time accelerated courses should be abandoned and specialization avoided in favour of broad engineering fundamentals. An attempt to stimulate ingenuity and encourage leadership is advocated, and emphasis given to preparation for citizenship by the inclusion of non-technical subjects.

6(07) **1125**

Education and Training for Engineers: Second Report – Part-Time Further Education at Technical Colleges.—I.E.E. Subcommittee. (*J. Instn elect. Engrs*, Part I, Nov. 1945, Vol. 92, No. 59, pp. 416–422.) Report of a discussion of 3160 of 1945.

6(07) **1126**

The Education of an Engineer as an Administrator.—W. E. Clegg. (*J. Instn Engrs, Aust.*, Sept. 1945, Vol. 17, No. 9, pp. 173–180.)

6(07) **1127**

"A Senior Engineer's Views on Technical Education and Training".—S. H. Richards. (*J. Instn elect. Engrs*, Part I, Jan. 1946, Vol. 93, No. 61, pp. 33–36.) Discusses implementation of the two I.E.E. Reports on Education and Training of Engineers (2545 of 1943, and 3160 of 1945). Inaugural address of Chairman, Measurements Section, I.E.E.

6(07) : [621.396/.397 **1128**

"Apprenticeship and Training Systems in the Radio Industry".—(*J. Instn elect. Engrs*, Part III, Dec. 1945, Vol. 92, No. 20, pp. 259–260.) Report of I.E.E. discussion led by J. Greig considering the electrical and mechanical craftsmanship required in industry, and the relative importance of physics and engineering in the training of technicians for research and development.

616-001 : 537.533 **1129**

Dangers Inherent in Scattered Cathode Rays.—L. L. Robbins. (*Science*, 14th Dec. 1945, Vol. 102, No. 2659, p. 623.) A note on burns experienced after brief exposure to scattered electrons. In some respects these are similar to ordinary X-ray or thermal burns. Such scattered electrons appear to have a very limited depth of penetration.

621.316.9 **1130**

Electrical Accidents.—"Supervisor". (*Electrician*, 28th Sept. 1945, Vol. 135, No. 3513, pp. 319–320.) Discussion of "Electrical Accidents", annual report of the Senior Electrical Inspector of Factories. For summaries of the report, see *Electrician*, 31st Aug. 1945, Vol. 135, No. 3509, pp. 216–218, also 4104 of 1945.

621.38 + 621.396.69 **1131**

Electronics at the Physical Society's Exhibition.—(*Electronic Engng*, Jan. 1946, Vol. 18, No. 215, pp. 13–20.) Incomplete descriptive alphabetical list of equipment of general electronic interest shown at the exhibition.

621.38 + 621.396.69 **1132**

British Electronic Apparatus : Further Examples of Electronic Equipment shown at the Physical Society's Exhibition.—(*Electronic Engng*, Feb. 1946, Vol. 18, No. 216, pp. 34–44.) Continuation of 1131 above, including classified list of products and exhibitors.

621.38 + 621.396.69 **1133**

Physical Society's Exhibition.—(*Wireless Engr*, Feb. 1946, Vol. 23, No. 269, pp. 58–62.) The exhibition ". . . was characterized by two things —the overwhelming preponderance of wireless and allied equipment and the enormous variety of such apparatus." The review is divided into the following sections :—measuring instruments : a.f. oscillators : v.h.f. equipment : industrial electronics : components, accessories and materials.

621.396.721 **1134**

Ham Radio.—R. Washburne & A. Williams. (*Radio News*, Dec. 1945, Vol. 34, No. 6, pp. 38..92). Future of the U.S. amateur field. Code of conduct and postwar frequency allocations. Application of wartime developments in components, tubes, etc., and amateur use of new techniques of f.m., facsimile and radar. A 9-page article.

621.396.721 **1135**

The New Licence.—(*R.S.G.B. Bull.*, Dec. 1945, Vol. 21, No. 6, pp. 83–84.) The conditions for the new transmitting licence for amateurs in Great Britain.

621.396.82 : 34 **1136**

Wireless Legislation.—(*Wireless World*, Jan. 1946, Vol. 52, No. 1, pp. 6–7.) A short account of the attitude of English law to radio transmissions and interference.

658.5 : 621.396.6 **1137**

Case Studies of Production.—M. Lechner. (*Electronics*, Dec. 1945, Vol. 18, No. 12, pp. 140–146.) The output of electronic apparatus was greatly increased by the use of suitable jigs and fixtures along the production line, and by instilling a sense of responsibility and interest into the persons concerned.

001.89 : 6 **1138**

The Future of Industrial Research [Book Review].—Standard Oil Development Company. Journal of Chemical Education, Easton, Pennsylvania, 1945, 173 pp. (*Rev. sci. Instrum.*, Oct. 1945, Vol. 16, No. 10, pp. 289–290.) Combination of twelve papers presented by prominent Americans, with comments and discussion. ". . . it undoubtedly is the most faithful and compact record of qualified opinion on the subject yet offered."

621.3 **1139**

Electromagnetic Engineering : Vol. I. Fundamentals [Book Review].—R. W. P. King. McGraw-Hill Co., New York, 1945, 580 pp., $6.00. (*Rev. sci. Instrum.*, Oct. 1945, Vol. 16, No. 10, pp. 287–288.)

621.3 (031) **1140**

"Electrical Engineer" Reference Book [Book Review].—E. Molloy, M. G. Say, R. C. Walker & G. Windred (Eds.). Geo. Newnes Ltd., London, 42s. (*Electronic Engng*, Feb. 1946, Vol. 18, No. 216, p. 62.) "The professional engineer will find this book an indispensable source of reference and information . . ."

621.392.081 **1141**

The Decibel Notation and its Applications to Radio Engineering and Acoustics [Book Review].—V. V. L. Rao. Addison & Co., Madras, India, 1944, 176 pp., $3.00 (in U.S.A.). (*Proc. Inst. Radio Engrs*, Dec. 1945, Vol. 33, No. 12, p. 903.)

621.396(05) **1142**

Annales de Radioélectricité [Book Review].—(*Wireless Engr*, Feb. 1946, Vol. 23, No. 269, p. 57.) The first number of a new journal published by the "Centre d'information et de documentation" of the Compagnie Générale de T.S.F. "promises to make a very useful contribution to the current literature of radio research and development".

621.396.029.6 **1143**

U.H.F. Radio Simplified [Book Review].—M. S. Kiver. D. Van Nostrand Co., New York, 1945, 236 pp., $3.25. (*Proc. Inst. Radio Engrs*, Dec. 1945, Vol. 33, No. 12, p. 903.) ". . . intended primarily for the use of radio amateurs ; laboratory and technical assistants . . . and others who have some technical knowledge and experience, would profit by a simple descriptive treatment of the subject."

ABSTRACTS AND REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abstracts of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO-FREQUENCIES

534.1 : 621.396.619.018.41 **1144**

Push-Pull Frequency Modulated Circuit and its Application to Vibratory Systems.—A. Badmaieff. (*J. Soc. Mot. Pict. Engrs*, Jan. 1946, Vol. 46, No. 1, pp. 37–51.) A circuit in which the push-pull action is accomplished by using two capacitors with a common plate to vary the resonant frequencies of oscillator and discriminator in opposite phase relation. This circuit can be used for measuring vibrations or for monitoring purposes if the common plate is the moving element of a vibratory system. For application to the calibration of gramophone recording heads, see 3548 of 1945 (Roys).

534.121.1 **1145**

The Fundamental Frequency of Vibration of Rectangular Wood and Plywood Plates.—R. F. S. Hearmon. (*Proc. phys. Soc.*, 1st Jan. 1946, Vol. 58, No. 325, pp. 78–92.) Results of theoretical and experimental investigation.

534.321.9 **1146**

Ultrasonic Interference at Angular Reflection.—G. W. Willard. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 284.) Abstract of an Amer. Phys. Soc. paper.

534.321.9 : 538.652 **1147**

Magnetostrictive Oscillator Coupling.—H. Thiede. (*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, p. 96.) A ceramic piston coupler allows the application of a magnetostrictive oscillator under circumstances beyond its normal operative range, such as ultrasonic excitation of liquids (acids or bases) up to 700°C. Abstract of a paper in *Akust. Z.*, Vol. 8, No. 1.

534.321.9 : 620.179 **1148**

Supersonic Flaw Detector.—R. B. De Lano, Jr. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 132–136.) The radar principle of pulse reflection from discontinuities is used with longitudinal supersonic waves of frequency 0.5–12 Mc/s. Pulses, a few microseconds long, and with a 60 c/s repetition rate, are applied by a quartz crystal transducer to the material under test, efficient coupling being obtained by a film of liquid. The same crystal serves as a pickup for the reflected pulses, which are amplified and displayed on a c.r. tube with an exponential time base and time marks, enabling the depth of the discontinuity to be measured.

The supersonic characteristics of various materials and pictorial examples of the performance of the instrument are given. See also 822 of April (Firestone).

534.321.9 : 620.179 **1149**

Ultrasonic Vibrations Reveal Hidden Flaws.—(*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, pp. 64..166.) Supersonic waves (50 kc/s–1 Mc/s) are transmitted from a crystal vibrator to a crystal microphone through a moving strip or sheet to be tested. A flaw causes a change in attenuation, and the change in the received signal actuates a relay. The arrangement is useful for examining extruded products.

534.41 + 534.781 **1150**

Visible Speech Patterns Transmit Intelligence.—(*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 200..202.) A short account of 823 of April (Potter).

534.42 **1151**

Electronic Sound Effects Circuit.—H. Syzling. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 214..220.) Description of a battle-sound generator giving an output of 200 W, with automatic operation. Circuits for generating the sounds of near and distant shell bursts, machine guns, etc., are briefly described.

534.43 : 621.395.61 **1152**

FM Phonograph Reproducer.—W. Hausz. (*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, p. 106.) A capacitive pickup unit. The needle vibrations vary the frequencies of two h.f. oscillators in push-pull, and the frequency-modulated difference frequency is filtered and detected. The mechanical design reduces the effect of eccentric records. Summary of U.S. Patent 2 386 049.

534.43 : 621.395.61 **1153**

New Vibrating Reed Magnetic Pickup.—R. G. Leitner. (*Radio*, Dec. 1945, Vol. 29, No. 12, pp. 25..63.) Design and construction. Output 2.5 mV at 1 000 c/s. Cut-off 6 000 c/s, but a special broadcast model cuts off at 12 000 c/s.

534.43 : 621.395.61 **1154**

[Gramophone] **Pickup with Low Mechanical Impedance.**—H. P. Kalmus. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 140–145.) Amplitude modulation of a 2.5 Mc/s oscillator is produced by the motion of a resistive vane which is coupled to the stylus and varies the *Q* of the oscillator circuit. The triode oscillator acts simultaneously as a detector and a.f. amplifier. High compliance and small mass of the moving element result in low mechanical impedance, so that only 14 grammes weight is needed for satisfactory tracking. The response falls sharply at 4 000–5 000 c/s.

534.845 : 534.373 **1155**

The Application of the Helmholtz Resonator to the Measurement of Sound Absorption.—W. S. Tucker. (*Phil. Mag.*, July 1945, Vol. 36, No. 258, pp. 473–485.) The resonance curve of a Helmholtz resonator excited by a sound field depends on, among other factors, the absorbing power of its walls. In the experiments described this fact was utilized to determine the absorbing power of porous earthenware over the range 150–600 c/s. A hot-wire (Tucker) microphone, located in the open mouth of the resonator, was used as the detector.

534.845 : 677.521 **1156**

A Discussion of the Acoustical Properties of Fiberglas.—W. M. Rees & R. B. Taylor. (*J. Soc. Mot. Pict. Engrs*, Jan. 1946, Vol. 46, No. 1, pp. 52–63.) The absorbing properties are discussed, with particular reference to aircraft sound insulation. Absorption tables for frequencies up to 4 000 c/s are given.

534.862.6 **1157**

Intermodulation Distortion of Low Frequencies in Sound Film Recording.—F. G. Albin. (*J. Soc. Mot. Pict. Engrs*, Jan. 1946, Vol. 46, No. 1, pp. 4–16.) An account of the phenomenon in variable-density recording, due to the photographic process.

537.228.1 **1158**

The Order of Magnitude of Piezoelectric Effects.—Jaffe. (*See* 1264.)

621.395.6 **1159**

War Influence on Acoustic Trends.—H. S. Knowles. (*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, pp. 81, 192.) An account of some of the special measures needed to transmit intelligence through the very high noise levels of battle conditions. Summary of an I.R.E. paper. See also *Electronics*, Jan. 1946, Vol 19, No. 1, pp. 246..248.

621.395.613.37 **1160**

Antinoise Characteristics of Differential Microphones.—H. E. Ellithorn & A. M. Wiggins. (*Proc. Inst. Radio Engrs, N.Y.*, Feb. 1946, Vol. 34, No. 2, pp. 84–89.) The noise discrimination is obtained as a function of frequency and pressure-gradient for both practical and theoretical microphones. It is shown that the differential microphone is ideally suited for noise cancellation in the usual noise fields, in which the frequencies are often predominantly in the lower frequency range. The noise discrimination increases rapidly with the order of the pressure gradient upon which the microphone operates, but the use of high order gradients presents constructional difficulties. The noise discrimination of the *n*th-order gradient is derived.

621.395.613.4 **1161**

Dynamic Microphone.—W. Baer. (*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, p. 99.) Illustrated description of the design of a moving-coil microphone. Air pockets behind the diaphragm give resonances at 450, 2 500 and 8 000 c/s, and thereby give high sensitivity and comparatively level frequency response. Diagrams illustrate the directional properties. The sensitivity is at least 100 μV/dyne.cm² for an output resistance of 200 Ω at 800 c/s. Overall efficiency 0.4%. Summary of a paper in *Akust. Z.*, Vol. 8, No. 4.

621.395.623.8 **1162**

Improved Sound Reproducer.—C. A. Volf. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 38..100.) General description of the system referred to in 531 of March.

621.395.623.8 **1163**

Psychological and Technical Considerations Employed in the Bucky Sound Reproduction and Public Address Systems.—P. A. Bucky. (*J. Soc. Mot. Pict. Engrs*, Jan. 1946, Vol. 46, No. 1, pp. 75–79.) Reactions of the physical senses to musical sounds are discussed. Replacement of conventional highly directive theatre or auditorium loudspeakers by another system with nondirectional characteristics is suggested. Reverberation from several speakers replaces the original sound picture, and an r.f. carrier is used for signal distribution.

621.395.625.3 **1164**

High Quality Sound Recording on Magnetic Wire.—L. C. Holmes. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 236..240.) Another report of the I.R.E. paper. See also 836 of April.

621.395.645 + 621.396.61/.62 **1165**

Low Power Transmitting/Receiving/and Hailing Equipment. Type CNY.1.—Morcom. (*See* 1386.)

621.395.645.3 **1166**

An Analysis of the Comparison of Beam Power and Triode Tubes Used in Power Amplifiers for Driving Loudspeakers.—J. K. Hilliard. (*J. Soc. Mot. Pict. Engrs*, Jan. 1946, Vol. 46, No. 1, pp. 30–36.) The beam power tube is equally efficient with the same or less distortion, has an improved signal/noise ratio, and the associated circuit need not be complicated. Excellent output transformers are required. Results of listener and objective tests.

621.395.645.3 **1167**

Bridging [a. f.] **Amplifier for F-M Monitoring.**—Beggs. (*See* 1199.)

621.395.645.36 **1168**

Quality Amplifiers.—(*Wireless World*, Feb. 1946, Vol. 52, No. 2, p. 61.) Correction to a circuit in 838 of April.

621.395.665 **1169**

Mixing Crystal Microphones.—G. N. Patchett. (*Wireless World*, Feb. 1946, Vol. 52, No. 2, pp. 57–58.) The difficulty of providing high-impedance inputs and adequate volume control, when it is required to mix the outputs from two or more crystal microphones, is overcome by using heptodes with a common anode load. Each microphone output is connected separately to the control grid of a heptode of which the amplification is controlled by the bias of its third grid.

621.395.667 **1170**

A Three-Band Variable Equalizer.—L. D. Grignon. (*J. Soc. Mot. Pict. Engrs*, Jan. 1946, Vol. 46, No. 1, pp. 64–74.) Provides suppression and emphasis in three frequency bands, adjustable by three controls. The features include zero insertion loss, and small change in apparent insertion loss as equalization is varied.

621.396.611.21.029.3 + 621.317.761 **1171**

Stabilizing Frequency in LF [1–10 kc/s] **Crystal Oscillators.**—Cox. (*See* 1294.)

AERIALS AND TRANSMISSION LINES

621.392 **1172**

Contribution to the Theory of Telephone Cables with Twisted Conductor Groups.—C. G. Aurell. (*Ericsson Technics*, 1944, No. 45, p. 3.) The transmission properties are developed along the same lines as for a system of parallel homogeneous conductors. Explicit formulae for the propagation constants and characteristic impedances for the conductors of such groups are deduced. The analysis is applied to the crosstalk problem.

621.392 **1173**

The Solution of Transmission-Line Problems in the Case of Attenuating Transmission Line.—G. Glinski. (*Trans. Amer. Inst. elect. Engrs*, Feb. 1946, Vol. 65, No. 2, pp. 46–48.) Demonstration of how " by application of the standard transmission line theory the standing-wave method of measuring impedance can be extended to the case of transmission lines with attenuation, if the appropriate corrections are introduced." The paper assembles and systematizes information on the subject in other literature.

621.392 **1174**

Discontinuity Effects.—G. Glinski. (*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, pp. 97–98.) The effect of a discontinuity in a transmission line is determined by locating the voltage minimum on each side of it. For a coaxial line, the position of the voltage minimum on one side of a discontinuity is graphed *versus* the position of a short-circuit on the other side, and the diagram is interpreted.

621.392 **1175**

Minimum Attenuation in Waveguides.—E. N. Phillips. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 137–139.) Algebraic and graphical presentation of the attenuation in rectangular and circular wave guides for various modes of propagation. The ratio of the frequency of minimum attenuation (f_{min}) to the cut-off frequency (f_c) for H modes in a rectangular guide is derived as a function of the ratio a/b of the sides, and the mode numbers n, m. For E modes, $f_{min} = \sqrt{3} f_c$. The attenuation of an $H_{0,1}$ wave in a typical rectangular brass guide is evaluated by way of illustration, and compared with brass concentric lines of the same cross-section area or the same periphery.

621.392 : 621.396.67 **1176**

Aerial Resistance and Cable Impedance.—G.W.O.H. (*Wireless Engr*, March 1946, Vol. 23, No. 270, pp. 65–66.) The approximate equality of the radiation resistance of a half-wave dipole in free space to the characteristic impedance of a coaxial cable with conductor diameter ratio giving minimum attenuation loss, is shown to be coincidental.

621.392 : 621.396.692 **1177**

Radio-Frequency Resistors as Uniform Transmission Lines.—D. R. Crosby & C. H. Pennypacker. (*Proc. Inst. Radio Engrs, N.Y.*, Feb. 1946, Vol. 34, No. 2, pp. 62–66.) A theoretical analysis, using the classical transmission line equations, of concentric lines with resistive inner conductors, the resistance being in the form of a film so that skin effect is negligible. The resistive element is long compared with the diameter of the outer conductor. The case where the resistor is intended to match a coaxial line is given particular attention, and the results are presented in a number of graphs which should be convenient for engineering use.

621.392.43 **1178**

Shunt and Series Sections of Transmission Line for Impedance Matching.—C. T. Tai. (*J. appl. Phys.*, Jan. 1946, Vol. 17, No. 1, pp. 44–50.) Expressing the terminal impedance to be matched as a hyperbolic function enables the matching conditions of both series and shunt sections to be simply expressed in terms of the resistance and reactance of the load and the characteristic impedance of the line. A graphical representation of the solutions shows that matching for each case is only possible inside certain areas bounded by a circle and straight line, on a graph of load resistance against load reactance. The series section permits matching over a wider range of impedances than the shunt section, but the latter is useful in the region where the series section cannot yield a match. If an additional section of line is added between the matching section and the load, then both sections can be made to match any load.

621.396.11 + 621.396.82 **1179**

Notes on the Reception of Vertically Polarized Electromagnetic Waves ; Some Notes on Circuit Shielding.—(*Radio, N.Y.*, Dec. 1945, Vol. 29, No. 12, pp. 39–40.) A radio design worksheet.

621.396.67 **1180**

Three New Antenna Types and Their Applications.—A. G. Kandoian. (*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 70–75.) All are primarily for v.h.f. and u.h.f. operation. Their radiation is substantially omnidirectional in the horizontal plane. A disk and cone type has a high-pass cut-off frequency above which the input impedance varies little over a 5 : 1 frequency range. A coaxially fed horizontal loop (" magnetic dipole") can be designed to match a coaxial line of *e.g.* 50, 70, 100 Ω characteristic impedance at a particular frequency. An "electric-magnetic dipole" consisting of a coaxially fed horizontal loop with a vertical radiator rising from its centre gives an elliptically polarized field distributed roughly as for an ordinary $\lambda/2$ dipole. It may be useful for counteracting severe fading conditions, when vertical and horizontal field components will probably not vary at the same rate. Constructional details of all types are shown, and the applications, singly and in multiple arrays, are discussed.

621.396.67 **1181**

Remote Tuned Antenna.—(*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, p. 77.) A motor operates the telescopic arms of a rotatable horizontal dipole, to cover a range 46.5 to 215 Mc/s.

621.396.67 **1182**

Currents in Aerials and High Frequency Networks. [Book Review]—F. B. Pidduck. Oxford University Press, London, 8s. 6d. (*Wireless Engr*, March 1946, Vol. 23, No. 270, p. 90.) " The book is of an ultra-mathematical character."

CIRCUITS

621.3.011.2.012 **1183**

Impedance-Admittance Conversion Chart.—R. C. Paine. (*Electronics*, Jan. 1946, Vol. 19, No. 1, p. 162.) Simple chart for converting $Z = R \pm jX$ to $Y = G \pm jB$ and *vice versa*.

621.3.017 : 621.3.012.3 **1184**

Loss due to Shunt Resistance Inserted Between Matched Source and Sink.—(*Radio, N.Y.*, Dec. 1945, Vol. 29, No. 12, p. 37.) A design chart.

621.314.12 **1185**

D.C. Amplifier Coupling.—P. K. Chatterjea & C. T. Scully. (*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, p. 118.) The use of a non-linear resistance element, such as a thermistor, permits the transmission of a large proportion of a voltage change from an anode to a grid, without transmitting a corresponding proportion of the mean anode potential. Summary of U.S. Patent 2 383 710.

621.318.572 : 621.385.38 **1186**

Pulse Response of Thyratron Grid-Control Circuits.—C. H. Gleason & C. Beckman. (*Proc. Inst. Radio Engrs, N.Y.*, Feb. 1946, Vol. 34, No. 2, pp. 71–77.) Advantages of peaked-waveform grid signals are discussed, and graphs given from which the influence of grid-circuit components on the grid-potential waveform can be predicted for several commonly used signal waveforms. The analysis is based on the assumption that the thyratron presents a relatively high impedance to the grid circuit, and the effect of grid current during the period prior to the initiation of the discharge is examined. In many cases the grid current is reasonably constant over a considerable range of negative grid voltage and the correction required to take account of it amounts to a shift in the d.c. bias value.

621.385.2/.5].012.8 **1187**

Valve Equivalent Circuit.—H. Biefer. (*Wireless Engr*, March 1946, Vol. 23, No. 270, pp. 91–92.) In valve circuit analysis, ambiguity can be avoided in the derivation of an equivalent circuit by attaching a definite sign to both current and voltage symbols. Comment on 3505 of 1945 (G. W. O. H.).

621.392.52 **1188**

Transient Response of Filters [part II].—D. G. Tucker. (*Wireless Engr*, March 1946, Vol. 23, No. 270, pp. 84–90.) The method given in part I (870 of April) for the analysis of the transient response of multistage filters is inapplicable to single-section filters, and a new method of approach, using operational methods, is given. The build-up and decay envelopes of a single-section filter, used between resistance terminations equal to its design resistance, are analysed, and the results compared with oscillographic records. The effects of slight variations in signal frequency are determined empirically by oscillographic methods.

621.394/.397].645 **1189**

Cathode-Follower Dangers: Output Circuit Capacitance.—W. T. Cocking. (*Wireless World*, March 1946, Vol. 52, No. 3, pp. 79–82.) It is shown that the particular advantages of the cathode-follower circuit are not maintained at frequencies so high that the time constant of the cathode circuit becomes significant. Very great care is needed in the design of cathode-follower circuits for television and radar frequencies, because the feed-back feature accentuates the distortion effect of this time constant on pulse shape, and the effects of momentary cut-off of anode current by excessive input. ". . . so far from the cathode-follower being able, by virtue of its low output resistance, to feed a circuit of high capacitance, it is usually necessary to restrict the capacitance to the lowest possible value."

621.394/.397].645.2 **1190**

Wide-Band Amplifiers — 1. Single Circuit RF and IF Couplings: Coincidence Tuning.—(*Wireless World*, March 1946, Vol. 52, No. 3, pp. 90–92.) General principles and detailed design formulae for wide-band couplings consisting of circuits individually tuned to the same frequency.

621.394/.397].645 : 621.396.822 **1191**

Noise Factor of Valve Amplifiers.—N. R. Campbell, V. J. Francis & E. G. James. (*Wireless Engr*, March 1946, Vol. 23, No. 270, pp. 74–83.) Conclusions of earlier papers are restated and applied to the design of valve amplifiers. General formulae for the noise and gain of an amplifier stage are used to derive particular formulae for the common-grid triode and the common-cathode pentode, account being taken of lead inductances and inter-electrode capacitances. Properties of perfect and dissipative four-terminal passive networks are discussed. The results are used to determine the effect on signal/noise ratio of the addition of extra stages to a cascade amplifier. The first of two parts. See also 1037 of April (Campbell & Francis) and 2918 of 1945 (Campbell, Francis & James).

621.394/.397].645.3 **1192**

Negative Feedback — 1.—"Cathode Ray." (*Wireless World*, Feb. 1946, Vol. 52, No. 2, pp. 41–44.) A simple explanation of the principle of negative feedback in amplifiers, dealing particularly with the difference between current and voltage feedback and their effects on the apparent internal resistance of the valve, considered in relation to the output load. For part 2 see 1193.

621.394/.397].645.3 **1193**

Negative Feedback — 2. Its Effect on Optimum Load and on Distortion.—" Cathode Ray." (*Wireless World,* March 1946, Vol. 52, No. 3, pp. 76–78.) For part 1 see 1192. The present article gives a graphical demonstration of the reduction of distortion by negative feedback, and explains why the best load resistance does not differ materially from that appropriate to the same valve without feedback.

621.394/.397].645.3 : 621.314.25 **1194**

Phase-Inverter Circuit.—C. B. Fisher: D. L. Drukey. (*Proc. Inst. Radio Engrs, N.Y.,* Feb. 1946, Vol. 34, No. 2, p. 92.) An application of the circuit described by Drukey (3846 of 1945). A high degree of balance and independence of tube characteristics is obtained, together with suppression of hum, tube noise, or distortion produced in the driver stage. A circuit diagram is given with component values.

621.394/.397].645.3 : 621.314.25 **1195**

An Analysis of Three Self-Balancing Phase Inverters.—M. S. Wheeler. (*Proc. Inst. Radio Engrs, N.Y.,* Feb. 1946, Vol. 34, No. 2, pp. 67–70.) " A self-balancing phase inverter is a circuit converting one driving voltage to two output voltages of opposite phase but of essentially equal magnitude by an inherent characteristic of the device and not by virtue of any critical adjustment. The algebraic solution of three self-balancing phase inverters is given, assuming all circuit elements are linear. Included in the solution are the conditions for self-balance, the balance ratio, and the voltage gain. From this information, the type of inverter for a particular service may be selected and designed."

621.395.44 : 621.395.645 **1196**

Carrier-Frequency Amplifiers: Transient Response with De-Tuned Carrier.—C. C. Eaglesfield. (*Wireless Engr,* March 1946, Vol. 23, No. 270, pp. 67–74.) An analysis by operational methods of the transient response of an amplifier whose central frequency may differ from the carrier frequency. The importance of the depth of modulation of the test input waveform is investigated, and reasons are given for making it small. Numerical solutions are given for typical arrangements of a chain of eight stages. See also 68 of January (Eaglesfield).

621.395.645.29 **1197**

A Cathode-Coupled [a.f.] **Isolating Amplifier.**—E. Travis. (*Electronics,* Jan. 1946, Vol. 19, No. 1, pp. 202..204.)

621.395.645.3 **1198**

An Analysis of the Comparison of Beam Power and Triode Tubes Used in Power Amplifiers for Driving Loudspeakers.—Hilliard. (*See* 1166.)

621.395.645.3 **1199**

Bridging Amplifier for F-M Monitoring.—G. E. Beggs, Jr. (*Electronics,* Jan. 1946, Vol. 19, No. 1, pp. 152–155.) The amplifier uses push-pull triodes throughout. The input stage is followed by a driver with a five-step gain control. Transformer coupling to the output stage is used, with negative feedback from output anodes to driver cathodes. A uniform response within ± 0.5 db, with 15 W output for 0.3 V r.m.s. input is obtained over the frequency range 20 c/s–25 kc/s and the signal/noise ratio at maximum output is about 80 db. The amplifier is designed for use with a balanced input but may be used with a single-ended input by earthing the unused grid.

621.395.645.36 **1200**

Quality Amplifiers.—(*Wireless World,* Feb. 1946, Vol. 52, No. 2, p. 61.) Correction to a circuit in 838 of April.

621.395.665 **1201**

Mixing Crystal Microphones.—Patchett. (*See* 1169.)

621.396.11 + 621.396.82 **1202**

Notes on the Reception of Vertically Polarized Electromagnetic Waves; Some Notes on Circuit Shielding.—(*Radio, N.Y.,* Dec. 1945, Vol. 29, No. 12, pp. 39–40.) A radio design worksheet.

621.396.611.1 **1203**

The Series and Parallel Components of Impedance.—W. N. Tuttle. (*Gen. Radio Exp.,* Jan. 1946, Vol. 20, No. 8, pp. 1–3.) Equations relating the series and parallel components of an impedance are applied to the case of parallel resonant circuits with high coil losses.

621.396.611.1.012.3 **1204**

Nomogram for Frequency Formula [$f = 1/(2\pi\sqrt{LC})$].—C. P. Nachod. (*Elect. Engng, N.Y.,* Dec. 1945, Vol. 64, No. 12, p. 469.)

621.396.611.21 **1205**

Electrodynamic Theory of Piezoelectric Oscillations.—W. F. G. Swann. (*Phys. Rev.,* 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 282.) The problem is that of an x-cut crystal with self-induction and resistance in series, and vibrating with its two ends in different media. It is solved on the basis of Maxwell's general dynamical theory. Abstract of an Amer. Phys. Soc. paper.

621.396.611.21 : 621.396.662.34 **1206**

Crystal Filter Theory.—F. J. Lehany & K. G. Dean. (*Radio, N.Y.,* Dec. 1945, Vol. 29, No. 12, pp. 8, 16.) Illustrated summary of 3820 of 1945.

621.396.615 **1207**

A New Type of Electrical Resonance.—E. E. Schneider. (*Phil. Mag.,* June 1945, Vol. 36, No. 257, pp. 371–392.) Utilization of phase inversion in a valve leads to a method of obtaining resonance with circuits containing only R and C or R and L. Such circuits are compared with known R-C oscillatory circuits, and the properties of reactance valve networks are discussed and analysed in detail. Experimental response curves are given for single and coupled R-C circuits at very low frequencies.

621.396.615.14.029.62/.63 **1208**

Asymmetrical Butterfly Circuit.—A. Landman. (*Proc. Inst. Radio Engrs, N.Y.,* Feb. 1946, Vol. 34, No. 2, p. 92.) A circuit of good stability, using an RL16 tube. The frequency range of the oscillator is restricted, in this case, to 290–350 Mc/s. See also 3260 of 1945 (Karplus) and 1209.

621.396.615.14.029.63 **1209**

Coaxial Modification of the Butterfly Circuit.—E. E. Gross. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 222 .. 226.) Another abstract of the I.R.E. paper. See also 883 of April.

621.396.615.17 **1210**

A New Pulse Generator Circuit.—B. M. Banerjee. (*Indian J. Phys.*, June 1945, Vol. 19, No. 3, pp. 75–82.) For many purposes, in particular for testing Geiger-Müller tube circuits, accurate synchronization between a pulse generator and a c.r.t. time base is needed. This is achieved by the generation of a separately available synchronizing pulse preceeding the main pulse by a fixed time interval. The assembly has three main parts—an unsymmetrical multivibrator, a pair of pulse generating networks, and a pair of pulse amplifiers biased beyond cut-off. The performance of the particular model described is :—pulse repetition frequency 2 c/s–200 kc/s ; pulse separation 2 μs–0.25 s ; pulse durations, main 1 μs–100 μs, sync 1 μs–500 μs. These are all independently variable. The generator produces negative pulses, triangular, 12 V peak. It is claimed that the generator is " a simple solution of all the radio sounding problems associated with ionospheric apparatus. It is therefore expected that it will find wide use in this field."

621.396.615.17 : 621.384.6 **1211**

Betatron Pulsing System.—I. Paul & T. J. Wang. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 156–160.) A circuit is described for producing high-power pulses for the orbit-shift coils of a betatron ; it has other applications, *e.g.* resistance welding and stroboscopic illumination.

A square-wave generator obtained from the sinusoidal voltage of the betatron coils is followed by a differentiator and flip-flop pulse amplifier producing a positive pulse of about 70 V amplitude. This is used to trigger a thyratron, which, suddenly discharging, fires an ignitron, which discharges a 60-μF capacitor through the orbit shift coils, giving a 1 000-A peak pulse, about 40 μs long at half amplitude.

621.396.615.17 : 621.397.3 **1212**

Television Sweep Oscillators.—Noll. (*See* 1381.)

621.396.619.018.41 : 534.1 **1213**

Push-Pull Frequency Modulated Circuit and its Application to Vibratory Systems.—Badmaieff. (*See* 1144.)

621.396.66 **1214**

Control and Recording with Floating Grid.—E. L. Deeter. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 172–198.) A large alternating voltage is applied through a very small capacitance (about 0.2 $\mu\mu$F) to the top-cap grid of a valve, normal grid leakage being avoided as far as possible. With a suitable voltage the capacitance provides a sensitive control of the anode current, which may be made to work a relay or recorder.

621.38 **1215**

Electronics for Engineers. [Book Review]—Markus & Zeluff. (*See* 1428.)

621.392 : 621.3.015.33 **1216**

Pulsed Linear Networks. [Book Review]—E. Frank. McGraw-Hill Book Co., New York, 1945, 262 pp., $3.00. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 348 .. 350.) See also 582 of March.

GENERAL PHYSICS

530.12 : 531.18 **1217**

Derivation of the Lorentz Transformations.—H. E. Ives. (*Phil. Mag.*, June 1945, Vol. 36, No. 257, pp. 392–403.) New derivation shows that the transformations can be obtained by imposing the laws of conservation of energy and momentum on radiation processes as developed by Maxwell's method. The solution of apparent conflicts demands the variation of mass with velocity, and the variation of linear dimensions and clock rate. The space and time concepts of Newton and Maxwell are retained without alteration.

530.12 : 538.3 **1218**

Relativistic Interaction of Electrons on Podolsky's Generalized Quantum Electrodynamics.—D. J. Montgomery. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 287.) Extension of the basis for a generalized electrodynamics involving higher derivations in the field equations formulated by Podolsky and Kikuchi (*Phys. Rev.*, 1944, Vol. 65, p. 228, and 1945, Vol. 67, p. 184.). Results are applied to the relativistic interaction of two electrons. Abstract of an Amer. Phys. Soc. paper.

531.4 + 539.62 + 621.394.653 + 621.395.653 **1219**

The Physics of Rubbing Surfaces.—F. P. Bowden. (*J. roy. Soc. N.S.W.*, 3rd Dec. 1945, Vol. 78, Part 3, pp. 187–219.) A comprehensive review of experimental information on the mechanism of frictional forces. The area of true contact is only a very small fraction ($\sim 10^{-4}$) of the total area of the apparently touching surfaces. The electrical conductance between two given materials is independent of the area of the apparently touching surfaces, and is little affected by their state of roughness ; it depends mainly on the mechanical force between them. The deformation of the material at the points of true contact is mainly plastic rather than elastic.

The temperature at the true contact points when metals are rubbed together depends on load, speed of sliding and thermal conductance, but can be very high. Polishing is mainly due to melting at the contact points. A material with a high melting or softening point will polish a material that has a lower melting or softening point. The relative hardnesses at room temperature are unimportant.

Friction and surface damage of metals sliding very slowly so that contact temperature rise is not great depends on the relative hardnesses. The surface of the softer metal of a pair is ploughed out and torn ; the harder surface is comparatively undamaged, but fragments of the softer metal are welded on to it ; the damage to rubbing surfaces of similar homogeneous metals is more profound. Work hardening and deformation of rubbing metals occurs to a considerable depth below the actual track of the contact.

The theory of solid friction is examined. The use of metallic films as lubricants, and the use of bearing alloys are discussed. The effect of naturally occurring films of oxide and other impurities on the reduction of friction between metal surfaces is shown to be very large.

534 + 538.56 **1220**

The Wave Equation in a Medium With a [space-] **Variable Index of Refraction.**—P. G. Bergmann. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 286.) Abstract of an Amer. Phys. Soc. paper.

535.317 : 621.397 **1221**

[Optical] **Lens Aberrations in Picture Projection.**—Montani. (*See* 1379.)

535.43 **1222**

On the Theory of Light-Scattering.—A Note.—S. Parthasarathy. (*Phil. Mag.*, July 1945, Vol. 36, No. 258, pp. 510–514.) A continuation of an argument with Krishnan (see 3334 of 1940). The writer claims that Krishnan's results "have been vitiated by grave errors" and gives detailed reasons.

537.221 : 621.317.32 **1223**

A Modified Kelvin Method for Measuring Contact Potential Differences.—Meyerhof & Miller. (*See* 1282.)

537.525 **1224**

Small Perturbations of the Electric Discharge.—V. L. Granovsky. (*C.R. Acad. Sci. U.R.S.S.*, 10th July 1940, Vol. 28, No. 1, pp. 40–44. In English.) Equations were developed in a previous paper (*C.R. Acad. Sci. U.R.S.S.*, Vol 26, No. 9—Granovsky) describing the dynamic states of the plasma under diffusion conditions. In this paper conclusions are deduced from them for conditions of small perturbations. (a) The relations between the variable components of the discharge parameters do not depend on the external circuit. (b) The passage of a transient is aperiodic for gas pressures greater than a critical value, and damped oscillatory for lower pressures. (c) Forced oscillations (modulated discharge) are considered, and various semi-quantitative conclusions reached on the relationship between the modulating e.m.f. and the current, particle concentration, etc.

537.531(091) **1225**

X-Rays an Early Institute Topic.—(*Elect. Engng, N.Y.*, Dec. 1945, Vol. 64, No. 12, pp. 435–436.) Excerpts from papers delivered before the A.I.E.E. in 1896 on theoretical and practical aspects of X-rays.

537.533.8 **1226**

Erratum : Secondary Emission of Pyrex Glass.—C. W. Mueller. (*J. appl. Phys.*, Jan. 1946, Vol. 17, No. 1, p. 62.) Correction to the composition of the glass quoted in 3648 of 1945.

538.1 **1227**

Note on Magnetic Energy.—E. A. Guggenheim. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, pp. 273–276.) A note to correlate the magnetic energy equations obtained by Livens (2825 of 1945) with the author's previous results (3221 of 1936). These equations apply to any unique relation between B and H whereas those of Livens are based on "linear laws of induction". In the two cases considered by Livens it is shown that the formulae only differ from the author's by constants.

538.569.4 + 621.396.11.029.64 **1228**

The Absorption of Microwaves by Gases.—Hershberger. (*See* 1336.)

539.16.08 **1229**

Counters for Use in Nuclear Spectroscopy.—M. L. Wiedenbeck. (*Rev. sci. Instrum.*, Jan. 1946, Vol. 17, No. 1, pp. 35–37.) A description of several self-quenching counters for counting conversion electrons with energies as low as 20 000 eV arising from an excitation process having a cross section of the order of 10^{-34} cm^2.

539.16.08 : 621.385.5 **1230**

Use of 6AK5 and 954 Tubes in Ionization Chamber Pulse Amplifiers.—Parsegian. (*See* 1404.)

539.163.2.08 **1231**

The Theory of the 180° Magnetic Focusing Type of Beta Ray Spectrometer.—A. K. Saha. (*Indian J. Phys.*, June 1945, Vol. 19, No. 3, pp. 97–119.) Development of an expression for the transmission factor as a function of the magnetic field and the electron momentum. It is illustrated by the complete calculation of the factor for the Lawson and Tyler spectrometer.

621.385.833 **1232**

Space-Charge-Limited Beams in Electrostatic Fields.—Rose. (*See* 1313.)

5 **1233**

Science in Progress. Fourth Series. [Book Review]—Univ. Press, Yale, Oxford Univ. Press, London, 331 pp., $3.00. (*Proc. phys. Soc.*, 1st Jan. 1946, Vol. 58, No. 325, pp. 129–130.) A set of eleven essays by eminent scientists, including one by Rabi on molecular beams and r.f. spectroscopy.

530.145.6 **1234**

Elementary Wave Mechanics. [Book Review]—W. Heitler. Oxford Univ. Press, London, 1945, 136 pp., 7s. 6d. (*Proc. phys. Soc.*, 1st Jan. 1946, Vol. 58, No. 325, pp. 127–128.) "It is truly elementary, both in the demands which it makes on the previous knowledge and mathematical ability of the reader, and also in that it deals only with the elements of wave mechanics."

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.746.5 : 621.396.11 : 551.51.053.5 **1235**

The New Sunspot Cycle.—T. W. Bennington. (*Wireless World*, March 1946, Vol. 52, No. 3, pp. 83–85.) The rise in the sunspot number from its minimum in 1944 has been unusually rapid. The next maximum may be considerably higher than the last. It may occur before May 1948, or in 1949. The curves of 12-month running averages of sunspot numbers and of critical frequency show a remarkable parallelism and should enable the prediction of the long-period variation of these quantities for a short time ahead with great accuracy. The article gives very detailed anticipation of usable frequencies for various routes : *e.g.*, "Frequencies up to 22 Mc/s ought to be usable for good periods during the day in the early months [of 1946] for communication with U.S.A., falling to about 17 Mc/s during the summer and increasing to about 29 Mc/s next winter. When all the path is in darkness, 7 Mc/s will at first be the highest safe frequency, but next summer frequencies up to 14 Mc/s should be usable most of the night. By next winter 10 Mc/s may be usable throughout the night."

550.38 + 551.594.5 **1236**

The Aurora and Geomagnetism.—C. W. Gartlein. (*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, pp. 76–77.) An electron device now under development is expected to overcome the difficulty of observing weak auroral activity during the full moon period. Closer correlation between solar and magnetic intensity observations is foreseen. A brief survey of the relation between sunspots and magnetic storms produced by currents in the upper atmosphere, and their effect on communications. Summary of an I.R.E. paper. See also *Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 242..244.

550.38 **1237**

Secular Magnetic Variations as Transients.—W. M. Elsasser. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 285.) The higher harmonic components of the earth's magnetic field are subject to secular variations within periods of the order of a few hundred years. The inductance of the earth's metallic core is large and periods of spontaneous decay of currents in the core are calculated to be of the order of 10^4–10^5 years. Abstract of an Amer. Phys. Soc. paper.

551.594.223 **1238**

What are Fireballs?—E. A. Logan. (*Elect. Rev., Lond.*, 8th March 1946, Vol. 138, No. 3563, pp. 381–383.) It is suggested that fireballs (or ball lightning), which may be produced by cloud-to-cloud lightning, may be analogous to the vortex ring in structure.

LOCATION AND AIDS TO NAVIGATION

621.383 **1239**

Photoelectric Aid for the Blind.—(*See* 1309.)

621.396.82 : 621.396.9 **1240**

Radar Countermeasures.—D.G.F. (*See* 1356.)

621.396 [.9 + .94 **1241**

A Note on the Detection of Undersea Craft by Means of Low Frequency Radiation from Aircraft.—D. W. R. McKinley. (*Canad. J. Res.*, Nov. 1945, Vol. 23, Sec. A, No. 6, pp. 77–85.) " A semiquantitative examination is made of the chief factors affecting both the transmission of low frequency radiation from an aircraft to a submarine and the return of this energy to the aircraft by scattering. A general expression is derived for the returning field strength and graphs are shown for a representative set of conditions. It is indicated that, even under the most favourable conditions, the amount of energy returned is below the level of detectability if the submarine is submerged more than 10 ft. However, it is also pointed out that communication between a shore station and an undersea craft should be feasible under certain conditions."

621.396.9 **1242**

Decca Navigator : Continuous-Wave Navigation System.—(*Wireless World*, March 1946, Vol. 52, No. 3, pp. 93–95.) Marine position finding by means of pulse transmissions is limited by the propagation characteristics of the very high frequencies implicit in the use of very short pulses. The Decca system uses continuous waves and can therefore take advantage of the more favourable ground-wave propagation characteristics of frequencies of the order of 100 kc/s. For two synchronized transmitters the loci of receiving points associated with given constant phase differences are a family of hyperbolae. A third synchronized transmitter similarly determines another family of hyperbolae, and the ship can be located on the intersection of two hyperbolae by observations of the phase differences between the received signals. This is the essential theoretical basis of the Decca system. In practice, the master transmitte controls two remote phase-locked slave transmitters The difficulty of distinguishing between three transmissions on the same frequency is overcome by using three different frequencies, each of which is a submultiple of the same higher frequency (*e.g.*, 85 kc/s and 113.33 kc/s, which are both submultiples of 340 kc/s). The receiver receives each transmission separately and generates the appropriate harmonics for comparison of phase differences. This, and other working details are described. See also 331 of February.

621.396.9 **1243**

Principles of Loran in Position Location.—R. W. Kenyon. (*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, pp. 106..140.) See also 605 and 606 of March (D.G.F.).

621.396.9 **1244**

The Future of Radar.—L. A. DuBridge. (*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, pp. 77, 80.) Sea and air navigation will be greatly improved by the use of Loran (long-range navigation) systems and by new microwave systems over shorter ranges. Summary of an I.R.E. paper. See also *Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 254..256.

621.396.9 **1245**

Fundamentals of Radar [:4].—(*Wireless World*, Feb. 1946, Vol. 52, No. 2, p. 65.) Correction to 927 of April.

621.396.9 **1246**

Radar in Merchant Ships.—S. T. Allsop. (*Wireless World*, Feb. 1946, Vol. 52, No. 2, pp. 66–67.) General description of a compact set, easy to install and maintain, intended to give warnings of icebergs, other surface craft and, with its p.p.i. presentation, to show the position and outline of a coastline. The accuracy is about 2° in bearing and 200 yards in range, with a maximum range of about 6 miles on a trawler target, but considerably more for larger ships or for a coastline. Three p.p.i. displays are provided, one in the main chassis and two in remote positions convenient for navigation. Operating frequency evidently about 10 000 Mc/s.

621.396.9 **1247**

Navigational Radar : Experimental Equipment for Use in Merchant Ships.—(*Wireless World*, March 1946, Vol. 52, No. 3, p. 89.) A description of a demonstration of a centimetre-wave p.p.i. system. " A demonstration run of nearly an hour's duration down one of the busiest shipping channels in the Thames Estuary showed that the ship could be conned with complete confidence through the traffic, leaving ships and buoys a cable's length on either hand. During the whole time the navigator based his helm orders solely on information given by the p.p.i. display."

621.396.9 **1248**

SCR-545 Radar.—(*Electronics*, Jan. 1946, Vol. 19, No. 1, p. 198.) Correction to data given in 612 of March.

621.396.9 **1249**

Radar on 50 Centimeters.—H. A. Zahl & J. W. Marchetti. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 98–104.) Description of the general arrangement, the aerial, and h.f. system, of a light-weight 600 Mc/s early warning radar type AN/TPS-3. Total weight, including generators and aerial, 1 200 lb. Range 120 miles. The equipment can be erected by four men in half an hour. The transmitter uses a single VT158 pulsed at 200 c/s by a spark-gap modulator, and feeds an array of three dipoles with reflectors, mounted in the focal plane of a 10-ft-diameter paraboloid. The outer dipoles can be switched in or out of circuit, to alter the coverage. The set gives range and azimuth only. Details are given of the rotating joint in the coaxial aerial feeder, and the t.r. system is illustrated. There is A-scope and p.p.i. display. To be continued.

621.396.9 **1250**

The [AN/] **MPG-1 Radar.**—H. A. Straus, L. J. Rueger, C. A. Wert, S. J. Reisman, M. Taylor, R. J. Davis & J. H. Taylor. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 110–117.) An account of the transmitting, r.f., receiver, and aerial systems of the 10 000 Mc/s fire-control radar described in 610 of March. The modulator is of the hard-valve, capacitor-discharge type, with a pair of pulse transformers to enable the high-voltage pulse from the modulator to be taken by line to the magnetron. The step-up transformer has a double secondary connected to make the magnetron filament transformer remain at earth potential as the filament itself becomes highly negative. The r.f. system consists of a "squeeze box" standing wave adjuster, t.r. and anti-t.r. switches, directional coupler monitor, rotating feed, horn and reflector. The squeeze box enables the greatest magnetron frequency stability to be obtained. The radiator consists of a folded horn with a parabolic cylinder as reflector, and produces a beam about 0.6° wide and 3° high. The scanning system is described.

621.396.9 : 061.6 **1251**

History and Activities of the Radiation Laboratory of the Massachusetts Institute of Technology.—L. A. DuBridge. (*Rev. sci. Instrum.*, Jan. 1946, Vol. 17, No. 1, pp. 1–5.) A war-time institution under the Office of Scientific Research and Development, set up to develop microwave radar.

621.396.9 : 623.454.25 **1252**

Radio Proximity Fuze.—Trotter. (*See* 1326.)

621.396.933.2 **1253**

Fundamentals of Radar : 5. Beacons Employing Pulse Technique.—(*Wireless World*, Feb. 1946, Vol. 52, No. 2, pp. 55–56.) Radar beacons, developed from the IFF system (3915 of 1945), with a transponder on the ground and an interrogator and responder in the aircraft, are used as homing and beam approach aids. With ranges up to 100 miles the aircraft may be within the working area of several beacons, so identification is given to each by interrupting the responses from the transponder. The equipment involved is simple, light and cheap, and should be of great value in peacetime flying. See also 3914 of 1945.

621.396.933.2 **1254**

Direction Finder.—M. Relson. (*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, pp. 120, 164.) "A rotating radiation pattern is frequency modulated with a frequency identical [with], or an exact multiple of, the frequency of rotation of the beam . . . . Upon amplitude and frequency demodulation, two signals are obtained in the receiver, phase comparison of which indicates the position of the aircraft with respect to the transmitter station." Summary of U.S. Patent 2 377 902.

621.396.933.23 **1255**

Microwave Instrument Blind Landing System.—Sperry Gyroscope Co. (*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, pp. 60..136.) Equipment operating at 2 617 Mc/s. Two transmitters in separate trailers and operating 23 Mc/s apart feed parabolic reflectors to produce the glide and localizer paths. The beams are switched at 60 c/s to produce intersecting lobes which are modulated at 600 and 900 c/s respectively. The receiver has a mechanical indicator to give the position of the plane relative to the correct approach line.

621.396 : 629.13 **1256**

Aviation Radio. [Book Review]—H. W. Roberts. W. Morrow & Co., New York, 1945, 637 pp., $5.00. (*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, p. 162.) "A complete study of the subject usable both by the novice and the professional."

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788 **1257**

Calibration of Ionization Gauge for Different Gases.—S. Dushman & A. H. Young. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 278.) Preliminary notice, including a table of results, of calibrations for He, Ne, A, Kr, Xe, Hg, H_2, N_2.

533.5 **1258**

A Metal Packless Vacuum Valve.—E. Topanelian, Jr. & N. D. Coggeshall. (*Rev. sci. Instrum.*, Jan. 1946, Vol. 17, No. 1, p. 38.) An all-metal valve requiring no sealing grease or lubricant. A steel needle connected to a movable bellows engages a brass sealing. Pipe line connexions are through Kovar-to-glass seals.

534.845 : 677.521 **1259**

A Discussion of the Acoustical Properties of Fiberglas.—Rees & Taylor. (*See* 1156.)

537.228.1 + 539.32 + 621.3.011.5] : [546.32.85 + 546.39.85 **1260**

The Elastic, Piezoelectric and Dielectric Constants of Potassium Dihydrogen Phosphate (KDP) and Ammonium Dihydrogen Phosphate (ADP).—W. P Mason. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 282.) Measurements have been made of all the elastic, piezoelectric, and dielectric constants of KDP and ADP crystals through temperature ranges down to the Curie temperatures. KDP behaves in accordance with theory, but ADP undergoes a transition at $-125°C$ unconnected with the H_2PO_4 hydrogen bond system which controls the dielectric and piezoelectric properties. Abstract of an Amer. Phys. Soc. paper.

537.228.1 + 621.396.611.21 **1261**

The Acid Etching and Steam Treatment of Quartz Oscillator Plates.—D. Fairweather. (*Marconi Rev.*, Oct./Dec. 1945, Vol. 8, No. 79, pp. 136–146.) The methods of finishing quartz oscillator plates to the desired frequency, for frequencies of 3 Mc/s and higher, are examined critically. It is shown that for an etched plate $R = KF^2$, for constant etchant strength, where R is the rate of change of frequency, K is a constant and F is the plate frequency. Steam treatment, with a similar law, has little value as a method of adjusting plates to frequency, but does provide an alternative method of ageing and may be used to test the effectiveness of the etching processes.

537.228.1 **1262**

Methods of Orienting and Cutting Synthetic Crystals.—W. L. Bond. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 282.) The methods include optically orienting on a mounting board, securing by fast setting cement, grinding a reference face at a predetermined angle from the board edges, sawing with solution-cooled abrasive blades, and grinding to dimension with abrasive belts. The application of these to ADP is discussed. Abstract of an Amer. Phys. Soc. paper.

537.228.1 **1263**

Apparatus for Growing Single Crystals from Solution.—A. N. Holden. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 283.) Abstract of an Amer. Phys. Soc. paper.

537.228.1 **1264**

The Order of Magnitude of Piezoelectric Effects.—H. Jaffe. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 282.) Piezoelectric coefficients are given as figures of merit for the selection of different materials for various applications. For sound generators, pickups and microphones, Rochelle salt is still preferable, but for ultrasonic work in liquids, synthetic crystals may be preferred. Abstract of an Amer. Phys. Soc. paper.

537.228.1 : 537.531.9 : 549.514.1 **1265**

Relation Between Darkening by X-ray Irradiation and Permanence of Dauphiné Twinning in Quartz.—E. Armstrong. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 282.) Quartz plates were subjected to inversion to the high-temperature form and reinversion to low quartz. Each plate was then irradiated with X-rays from a copper target tube. There was positive correlation between the amount of darkening caused by the X-ray irradiation and the permanence of their Dauphiné twin boundaries when subjected to the inversion treatment. Abstract of an Amer. Phys. Soc. paper.

621.315.52 + 621.315.559].018.44 **1266**

The Electrical Resistance of Iron Wires and Permalloy Strips at Radiofrequencies.—A. W. Smith, J. H. Gregory & J. T. Lynn. (*J. appl. Phys.*, Jan. 1946, Vol. 17, No. 1, pp. 33–36.) Substitution of test specimens of the materials in place of a series of standard resistors in a circuit resonant at the required radio frequency f (between 1.5 and 6 Mc/s) enables the a.c. resistance R of the specimens to be obtained by interpolation. Comparison with the d.c. resistance R_o gives an empirical equation $R/R_o = 0.4 + 1.5\,d(f\mu\sigma/10^3)^{\frac{1}{2}}$ for iron wire and $R/R_o = A + f(a/b)\ 1.12\ (fab\sigma\mu/10^3)^{\frac{1}{2}}$ for permalloy strip of dimensions $a \times b$. d = wire diameter (cm), f = frequency (Mc/s), μ = permeability (gauss/oersted), σ = conductivity (mho/cm), A = empirical constant for each specimen, $f(a/b)$ = a function obtained from Cockroft (1929 abstracts, p. 224). These results are compared with existing theoretical work. "The relatively simple form of the empirical equation supports the hope that a definite physical meaning can be assigned to . . . A and . . . $f(a/b)$."

621.315.61 **1267**

Radio Insulating Materials: Part 4.—A. H. Postle. (*Radio, N.Y.*, Dec. 1945, Vol. 29, No. 12, pp. 33..60.) Preparation and properties of compression-moulded and transfer-moulded glass-bonded mica (permittivity 7). Higher permittivity materials (ϵ up to 20) in moulded forms, and temperature compensating materials having permittivities up to 80 and a temperature capacitance coefficient of 1 in 10^3 are available. For part 3 see 632 of March.

621.315.613.1 **1268**

Electrical Properties of Indian Mica: II. The Effect of Varying Relative Humidity.—P. C. Mahanti, M. K. Mukherjee & P. B. Roy. (*Indian J. Phys.*, June 1945, Vol. 19, No. 3, pp. 83–92.) A continuation of the work described in 3543 of 1943 (Datta, Gupta & Mahanti). The measurement was by substitution by a standard air capacitor, in a Schering bridge. Various methods of maintaining a known humidity in an enclosed space are described, including the use of saturated aqueous solutions of a range of salts such as calcium chloride, calcium sulphate, etc. The method chosen was the use of aqueous solutions of glycerin. This has the important advantage that the relative vapour pressure is substantially independent of temperature over the range 0–70°C, and that the solutions are easily standardized by measurement of refractive index. The results confirm those obtained by previous workers. The power factor begins to rise at about 40% relative humidity and rises steeply beyond 80%.

621.315.614 : 621.315.615 **1269**

The Electrical Resistivity of Resin-Treated Wood and Laminated Hydrolyzed-Wood and Paper-Base Plastics.—R. C. Weatherwax & A. J. Stamm. (*Trans. Amer. Inst. elect. Engrs*, Dec. 1945, Vol. 64, No. 12, pp. 833–838.) A report on measurements, giving experimental details. Graphs and data supplied show the variation of surface and volume resistivity with moisture content, resin content, and relative humidity, for the types of wood examined.

621.318[.22 + .322 **1270**

Magnetic Materials.—F. E. Robinson. (*Marconi Rev.*, Oct./Dec. 1945, Vol. 8, No. 79, pp. 125–135.) A review of recent improvements in the properties of hard and soft magnetic materials, obtained by cold working, heat treatment and variations of composition. The materials considered are divided into three groups, those suitable for permanent magnets, for power apparatus such as low-frequency generators, motors and transformers, and for sound and radio apparatus at frequencies up to 1 Mc/s.

621.318.322.017.3 **1271**

Hysteresis and Eddy Losses in Single Crystals of an Alloy of Iron and Silicon.—A. J. C. Wilson. (*Proc. phys. Soc.*, 1st Jan. 1946, Vol. 58, No. 325, pp. 21–29.) The total energy dissipated in single crystals of iron containing 2.1% silicon has been measured calorimetrically, for fields in the three crystallographic directions [100] [110] and [111], the losses being analysed by variation with frequency. The eddy losses do not depend on field direction, but the hysteresis loss for [100] is about one-third that for the other directions. A tentative theory is put forward.

621.385.832 **1272**

Phosphors and Their Behavior in Television [Part 1].—I. Krushel. (*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, pp. 100..134.) A general account of the properties of phosphors, including graphs showing spectral properties of common types, with a description of manufacturing processes.

621.385.832 **1273**

Phosphors and Their Behaviour in Television [Part II].—I. Krushel. (*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, pp. 92..150.) The following production methods of coating tubes are described and their advantages discussed :—spraying, dusting, settling, "flowing-on", and electrostatic deposition. Problems of "ion burn" and dissipation of screen charges are specifically treated. Contrast and brilliancy, although sufficient for direct viewing, are not at present adequate for satisfactory projection. For Part I see 1272.

621.315.6(083.75) **1274**

ASTM Standards on Electrical Insulating Materials (with related information). [Book Review]—ASTM Committee D-9. American Society for Testing Materials, Philadelphia, Pa., 1945, 560 pp., $3.25. (*Elect. Engng, N.Y.*, Feb. 1946, Vol. 65, No. 2, pp. 97–98.)

621.357.7 **1275**

Electroplating, A Survey of Modern Practice, including the Analysis of Solutions. [Book Review]—S. Field & A. D. Weill. Pitman Publishing Corp., New York, 5th edn. 1945, 483 pp., $5.00. (*Elect. Engng, N.Y.*, Dec. 1945, Vol. 64, No. 12, p. 470.)

MATHEMATICS

517.432 **1276**

The Steady-State Operational Calculus.—D. L. Waidelich. (*Proc. Inst. Radio Engrs, N.Y.*, Feb. 1946, Vol. 34, No. 2, pp. 78–83.) "The direct and inverse transforms of the steady-state operational calculus are presented, together with two methods of evaluating the inverse transform, the first resulting in a Fourier series and the second giving a sum function. A proof of the inversion theorem connecting the two transforms is outlined in the Appendix. Two examples are presented illustrating the application of this operational calculus to circuit problems, and a comparison is made between the ordinary and the steady-state operational calculuses."

517.941.91 **1277**

Computation of the Solution of Mathieu's Equation.—N. W. McLachlan. (*Phil. Mag.*, June 1945, Vol. 36, No. 257, pp. 403–414.)

517.5(021) **1278**

Lehrbuch der Funktionentheorie — Vols. I & II. [Book Review]—L. Bieberbach. Chelsea Publishing Co., New York, 1945, Vol. I (4th edn., 1934) 320 pp., $ 3.50, Vol. II (2nd edn., 1931) 368 pp., $ 3.25. (*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, p. 104.) American reprint of the German text.

517.564.4 : 518.2 **1279**

Tables of Associated Legendre Functions. [Book Review]—Mathematical Tables Project. Columbia University Press, New York, 1945, 303 pp., $5.00. (*Electronics*, Jan. 1946, Vol. 19, No. 1, p. 344.) Fourteen major tables of functions and their first derivatives with five supplementary tables. To about six significant figures at intervals of 0.1.

621.396.029.6 **1280**

The Mathematics of Ultra-High Frequencies in Radio. [Book Review]—L. N. Brillouin. Brown Univ., Providence, R.I., 1943, 210 pp. (*Proc. phys. Soc.*, 1st Jan. 1946, Vol. 58, No. 325, pp. 128–129.) A mimeographed record of a course of lectures at Brown University.

MEASUREMENTS AND TEST GEAR

621.3.012.3 : 621.3.081.4 **1281**

Decibel Conversion Chart.—R. C. Miedke. (*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 76–77.) The chart gives decibels directly from any two values of voltage, current, or power, for ratios up to 10 to 1, with an extended range for ratios up to 10^6 to 1.

621.317.32 : 537.221 **1282**

A Modified Kelvin Method for Measuring Contact Potential Differences.—W. E. Meyerhof & P. H. Miller, Jr. (*Rev. sci. Instrum.*, Jan. 1946, Vol. 17, No. 1, pp. 15–17.) The two surfaces are brought rapidly together and give a pulse to an electrometer tube used as a cathode follower. By adjusting the bias, this pulse is reduced to zero and measures the contact potential difference to 0.01 V.

621.317.32.015.33 : 621.385.2 **1283**

Pulse Response of Diode Voltmeters.—A Easton. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 146–149.) A theoretical and experimental investigation. Equation (11) gives the mean rectified voltage in terms of the parameters of the pulse and the voltmeter, and is closely confirmed by experiment. It is stressed that the input impedance may be relatively small for short pulses. When measuring very short pulses the voltmeter performance can be improved by the use of a cathode follower and a pulse-stretching circuit ; a practical arrangement is shown.

621.317.382.029.3 **1284**

Power Measurements at Audio Frequencies.—D. L. Waidelich. (*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, pp. 68–70.) Describes the three-voltmeter method as given by Laws in his book "Electrical Measurements" (2508 of 1938). A second method, using a network and two thermojunction milliammeters with the output e.m.f.s connected in opposition has a linear calibration. Variable resistors are used for setting up the scale accurately. The relative advantages of the two systems are enumerated.

621.317.39 **1285**

Electric Measuring Instruments.—D. M. Nielsen. (*Elect. Engng, N.Y.*, Feb., 1946, Vol. 65, No. 2, pp. 66–74.) A survey of the instruments used for the measurement of process variables such as temperature, pressure, flow, pH, etc., in terms of electrical variables, and of the way in which electronic devices are influencing the design of the sensitive elements, measuring mechanisms, and controlling mechanisms of the instruments. Table I lists electrically sensitive elements in terms of the physical variable measured, and Table II gives additional applications where the electrical element is combined with another responsive element. The basic features of electronic measuring instruments in general are given together with detailed descriptions of a commercial self-balancing bridge and three self-balancing potentiometers. Reasons are given for the increased use of electronic and electro-mechanical devices.

621.317.41 + 621.317.43] : 621.318.323.2.029.5 **1286**

Proposed Test Coils.—(*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, p. 71.) "Tentative standards for testing permeability and *Q* of powdered iron slugs $\frac{3}{8}$ inch in diameter and $\frac{3}{4}$ inch long."

621.317.42 **1287**

Fluxmeter.—Marion Electric Instrument Co. (*Rev. sci. Instrum.*, Jan. 1946, Vol. 17, No. 1, p. 41.) A direct-reading fluxmeter with overall accuracy better than 1%. A D'Arsonval movement is situated in the field to be measured, and the current observed that is required to give a standard deflexion. Field range 1 200–9 600 gauss.

621.317.7 + 621.38 + 621.396.69 **1288**

Physical Society's Exhibition: First Post-war Show of Testing and Measuring Gear.—(*Wireless World*, Feb. 1946, Vol. 52, No. 2, pp. 48–52.) See also 1131/1133 of April.

621.317.7 **1289**

The Physical Society's Thirtieth Annual Exhibition: Electrical Instruments.—G. H. Rayner. (*J. sci. Instrum.*, Feb. 1946, Vol. 23, No. 2, pp. 31–34.) A review of instruments including the electron microscope, voltmeters, frequency meters, a.c. bridges, oscillators, signal generators, and a new a.c./d.c. comparator. See also 1131/1133 of April.

621.317.71 : 621.396.67 **1290**

Remote Indicating Antenna Ammeter.—C. R. Cox. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 210..214.) A diode rectifier coupled to the antenna through a current transformer, with a d.c. microammeter giving approximately linear calibration.

621.317.734 **1291**

A Simple Ohmmeter.—"Calibrator". (*Wireless World*, Feb. 1946, Vol. 52, No. 2, p. 44.) Brief description of a circuit in which a single milliammeter is used alternately for measuring the current through and the p.d. across the unknown resistor. Resistances up to 10^5 Ω can be measured.

621.317.734 **1292**

Resistance Measurements.—S. Litt. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 44..135.) Review of various methods of resistance measurement, including commercial ohmmeters with accuracy of 1% for very low resistance values, and bridge-type ohmmeters of greater accuracy.

621.317.76 : 621.396.621 **1293**

Laboratory Receiver.—W. F. Frankart. (*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, pp. 71, 144.) Circuit details of a high-stability v.h.f. receiver for frequency deviation and mean carrier frequency measurements. It includes an r.f. stage, a frequency changer, and separate i.f. channels for a.m. and f.m.

621.317.761 + 621.396.611.21.029.3 **1294**

Stabilizing Frequency in LF [1–10 kc/s] **Crystal Oscillators.**—L. R. Cox. (*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, pp. 106..124.) The amplitude-frequency effect in duplex flexure mode is reduced from 2 in 10^5 to a few parts in 10^7 by the use of a varistor in a voltage-limiting circuit. Summary of U.S. Patent 2 385 260.

621.317.761.029.62/.64 **1295**

Introduction to U.H.F. Frequency Measurements.—G. Dexter. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 32..114.) The principles and limitations of various methods of frequency measurement above 150 Mc/s are described, including inductance-capacitance wavemeters and Lecher wire systems. A cavity resonator with crystal detector, and a heterodyne instrument with butterfly oscillator and crystal mixer, are described rather more fully.

621.317.79 : 537.228.1 **1296**

Quartz Crystal Measurement.—C. W. Harrison. (*Radio, N.Y.*, Dec. 1945, Vol. 29, No. 12, pp. 16..22.) Illustrated summary of 3325 of 1945.

621.317.79 : 621.396.615.12 **1297**

Test Oscillator for New AM-FM-Tele Needs.—W. Muller. (*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, pp. 86–89.) The necessary and desirable properties of a versatile standard-signal generator for f.m. and television frequencies are considered, and the design of a suitable instrument is discussed in detail. It covers the ranges 100 kc/s to 150 Mc/s, and 1μV to 1V, with provision for f.m. and a.m., and incorporates crystal-controlled oscillators at 100 kc/s and 1 Mc/s. It is claimed to be "almost fool-proof and obsolescence-proof".

621.317.79 : 621.396.615.14 **1298**

135 to 500 Mc. Signal Generator.—J. Wonsowicz & H. S. Brier. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 35..116.) A design within the scope of a home workshop is described. The frequency range of nearly 4 to 1 on a single band is given by a tank circuit of novel construction. An unbalanced output is obtained through a simple coaxial tapped line attenuator. Modulation at 400 and 1 000 c/s is provided.

621.317.79 : 621.396.62 **1299**

R.F.-I.F.-A.F. Signal Tracer [for receiver testing].—V. Cavaleri. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 50..133.) A 3-valve a.f. amplifier of which the input circuit acts as grid-leak detector for modulated r.f. and i.f. signals. A magic eye indicator is used for c.w. signals. Constructional details.

621.392.43 **1300**

Shunt and Series Sections of Transmission Line for Impedance Matching.—Tai. (*See* 1178.)

621.315.6(083.75) **1301**

ASTM Standards on Electrical Insulating Materials (with related information). [Book Review]—ASTM Committee D-9. (*See* 1274.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.321.9 : 620.179 **1302**

Supersonic Flaw Detector.—(*See* 1148/1149.)

537.531 **1303**

Some Experiences with the X-Ray.—W. D. Coolidge. (*Elect. Engng, N.Y.*, Dec. 1945, Vol. 64, No. 12, pp. 423–426.) Personal reminiscences of the author's work in the early days of X-ray development. Voltage-supply difficulties are mentioned and also modifications to tubes for practical application of X-rays. The article also appears in *Amer. J. Roentgenol.*

537.531 : [5 + 6 **1304**

Scientific Importance of X-Rays.—L. H. Garland. (*Elect. Engng, N.Y.*, Dec. 1945, Vol. 64, No. 12, pp. 437–444.) An outline of the applications and value of X-rays to industry and science in general, and particularly to medical science.

537.531 : 62 **1305**

Industrial X-Ray Developments.—C. D. Moriarty. (*Elect. Engng., N.Y.*, Dec. 1945, Vol. 64, No. 12, pp. 433–435.) An account giving special attention to modern methods of recording results. Radiographic, fluoroscopic and electrical methods of recording are discussed.

612.82.014.421 : 621.395.645 **1306**

Brain Wave Records in Medical Diagnosis.—F. Offner. (*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, pp. 72 . . 161.) The recording of potential differences on the surface of the scalp needs amplifiers with a frequency response from a fraction of a cycle to 10 kc/s, and an amplification of about 140 db. Four- or five-stage R-C coupled push-pull amplifiers with balanced input are used. A Rochelle-salt crystal-driven recorder gives a satisfactory recording speed for use up to 100 c/s.

621.365 [.5 + .92 **1307**

Case Studies of RF Heating.—Westinghouse Electric Corp. (*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, pp. 84–85.) Eight annotated photographs showing methods of solving typical industrial problems.

621.365.92 : 615.452 penicillin **1308**

Radio-Frequency Dehydration of Penicillin Solution.—G. H. Brown, R. A. Bierwirth & C. N. Hoyler. (*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 58–65.) Preliminary concentration of the solution under reduced pressure is effected by using a 2-kW 28-Mc/s oscillator. Further dehydration in bottles revolving at high speed reduces the moisture content to 4% in 3 minutes. The equipment can produce 2 000 dry bottles each hour.

621.383 **1309**

Photoelectric Aid for the Blind.—(*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 204 . . 210.) A device which is used to scan the path ahead. A beam of light is projected and any reflection from objects is detected by a photocell which produces coded tone signals in an earphone. The range limit is 20 ft, and the coded signal heard indicates the distance of the object. The equipment weighs 9 lb, but may be reduced to about 2 lb.

621.383 : 535.33.071 **1310**

Electronic Spectroscopy.—G. C. Sziklai & A. C. Schroeder. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 284.) The colour content of light falling on a photocell may be directly observed on an oscilloscope. The method lends itself to colour matching by using two similar devices giving signals of opposite polarity and hence zero combined output when the colours match. Abstract of an Amer. Phys. Soc. paper.

621.384 **1311**

Production of Particle Energies Beyond 200 Mev.—L. I. Schiff. (*Rev. sci. Instrum.*, Jan. 1946, Vol. 17, No. 1, pp. 6–14.) The betatron, synchrotron, microtron, linear resonator accelerator, linear waveguide accelerator, and relativistic ion cyclotron are proposed and briefly described.

621.385 **1312**

Physical Limitations in Electron Ballistics.—Pierce. (*See* 1395.)

621.385.833 **1313**

Space Charge-Limited Beams in Electrostatic Fields.—M. E. Rose. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 287.) The case dealt with is the circularly symmetric beam of finite cross section. Only first-order optics in which the aberration is due to space charge is treated. Abstract of an Amer. Phys. Soc. paper.

621.385.833 **1314**

On the Improvement of Resolution in Electron Diffraction Cameras.—J. Hillier and R. F. Baker. (*J. appl. Phys.*, Jan. 1946, Vol. 17, No. 1, pp. 12–22.)

621.385.833 **1315**

Complete Computation of Electron Optical Systems.—H. Motz & L. Klanfer. (*Proc. phys. Soc.*, 1st Jan. 1946, Vol. 58, No. 325, pp. 30–41.) The field of the system is calculated by relaxation (see also 658 of March—Motz & Worthy), and the electron trajectories by step-by-step integration. "The position of focal and cardinal points and the spherical aberration of the lens are found to be in fair agreement with experimental and semi-empirical determinations by other authors."

621.385.833 **1316**

Applied Electron Microscopy.—J. H. L. Watson. (*Canad. J. Res.*, Nov. 1943, Vol. 21, Sec. A, No. 11, pp. 89–98.) The technique of taking stereoscopic photographs, and its adaptation to give electron diffraction patterns, is described in relation to the examination of mine dust, clays, and the structure of botanical specimens.

621.385.833 **1317**

Electron Microscope Society of America.—(*J. appl. Phys.*, Jan. 1946, Vol. 17, No. 1, pp. 66–68.) Abstracts of 25 papers from the Society's programme.

621.385.833 **1318**

Applications of Metallic Shadow-Casting to Microscopy.—R. C. Williams & R. W. G. Wyckoff. (*J. appl. Phys*, Jan. 1946, Vol. 17, No. 1, pp. 23–33.)

621.385.833 **1319**

A High Speed Microtome for the Electron Microscope.—E. F. Fullam & A. E. Gessler. (*Rev. sci. Instrum.*, Jan. 1946, Vol. 17, No. 1, pp. 23–35.)

621.389 : 778.52 **1320**

Electronic Timing of Sequence Photographs.—C. H. Coles. (*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, pp. 74–76.) Circuit details and photographs of apparatus for photographing bullets in flight. A rising voltage is applied to a number of valves biased to different amounts beyond cut-off. As each valve conducts, it applies a pulse to a stroboscopic lamp. 6 lamps may be fired in succession in a time between 35 microseconds and ½ second.

621.398 : 621.318.5 **1321**

Industrial Relay Control Circuits.—R. R. Batcher. (*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, pp. 94 . . 134.) Methods of remote control are outlined. The operation of simple relays is described, and it is shown how complex problems are solved by combinations of relays. Selective control is effected by pulse-operated switching circuits of the types used in telephone exchanges.

621.398 : 623 **1322**

Radio Control of German V-2 Rockets.—(*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, p. 89.) Brief note only. See also 4135 of 1945.

621.398 : 629.13 **1323**

Radio Operated Airplane.—S. R. Winters. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 29..159.) Four a.f. tones on a u.h.f. carrier control a small plane. Switching off a fifth tone stops the engine and releases a parachute. See also 1324 below.

621.398 : 629.13 **1324**

Radio-Controlled Target Airplane Developed by ATSC.—(*Radio News*, Jan. 1946, Vol. 35, No. 1, p. 66.) See also 1323 above and 1013 of April.

623.26 : 621.396.9 **1325**

Vehicular-Mounted Mine Detector.—H. G. Doll, M. Lebourg & G. K. Miller. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 105–109.) A device that automatically stops the vehicle on detection of a metal mine or on failure of the electronic apparatus. Four circular horizontal coils side by side and in series are for transmitting (presumably a.f.). Four receiving coils are fixed on top of the transmitters, and the mutual inductance between transmitting and receiving circuits is neutralized by a group of transformers in opposite polarity in series with the coils. The coil assembly forms the detector element, and is electrostatically screened. Residual signals in the receiving circuit are neutralized by the injection of a signal automatically controlled by a long-time-constant circuit to counteract drift from balance. Passage of the detector over a mine causes a sudden change in mutual impedance between the coils, too quick for automatic compensation, and the resulting signal in the receiver operates braking relays. The arrangement is particularly sensitive to change in the resistive component of the mutual impedance, which is of advantage in discriminating against false signals. The complete circuit diagram is given with component values.

623.454.25 : 621.396.9 **1326**

Radio Proximity Fuze.—H. Trotter, Jr. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 226..228.) Summary of an I.R.E. paper describing the history of the subject.

016 : 621.386.1 : 620.179 " 1942/1945 " **1327**

Bibliography on Industrial Radiology. [Book Review]—H. R. Isenburger. St. John X-Ray Service, Inc., Long Island City, N.Y., 16 pp. $1.00. (*Electronics*, Jan. 1946, Vol. 19, No. 1, p. 344.) Mimeographed list of about 400 items published between 1942 and 1945. Supplement to 723 of 1944.

621.38 : 62 **1328**

Elementary Engineering Electronics. [Book Review]—A. W. Kramer. Instruments Publishing Co., Pittsburgh, Pa., 1945, 344 pp., $2.00. (*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, p. 128.)

PROPAGATION OF WAVES

534 + 538.56 **1329**

The Wave Equation in a Medium With a [space-] **Variable Index of Refraction.**—P. G. Bergmann. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 286.) Abstract of an Amer. Phys. Soc. paper.

621.396.11 **1330**

Polarized Radiation.—J. Grosskopf & K. Vogt. (*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, p. 113.) Summary of 2842 of 1944, with two graphs.

621.396.11 **1331**

Propagation Effects.—(*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, pp. 65..142.) A brief report of a conference held at the Cosmic Terrestrial Research Laboratory, Needham, Mass., on 11th Dec. 1945 on ionospheric and tropospheric propagation. Ionospheric and path absorption, sporadic " E " and scatter were discussed. Extended fade-outs were reported on 110 Mc/s over a distance of 70 miles which were greatly reduced by operation in the 40–50 Mc/s band. See also 1334.

621.396.11 : 523.746.5 : 551.51.053.5 **1332**

The New Sunspot Cycle.—Bennington. (*See* 1235.)

621.396.11 : 621.396.812.3 **1333**

Irregularities in Radio Transmission : Part I.—O. P. Ferrell. (*Radio, N.Y.*, Dec. 1945, Vol. 29, No. 12, pp. 27..61.) A review of evidence that " bursts " are due to low-level ionospheric reflections. A graph representing measurements made over 337- and 720-mile paths at a frequency of 42.3 Mc/s shows the average number of bursts per hour against field intensity of the received signal. The curve falls from 80 bursts per hour exceeding 6 μV/m, to 2 bursts per hour exceeding 26 μV/m. Twenty references are given.

621.396.11.029.62 **1334**

Tropospheric Study of FM Transmission.—C. W. Carnahan. (*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, pp. 78..146.) A long account of the I.R.E. paper by Carnahan. See also 1028 of April, and 1335 below.

621.396.11.029.62 **1335**

FM Tests.—F. C. C. (*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, pp. 80–81.) Report of controversy over the significance of results given in 1028 of April and in 1334 above (Carnahan). F.C.C. tests at 20 miles range are stated to indicate the reverse of the conclusions drawn from Carnahan's measurements.

621.396.11.029.64 + 538.569.4 **1336**

The Absorption of Microwaves by Gases.—W. D. Hershberger. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 284.) Fourteen gases give absorptions at about 1 cm wavelength comparable with that of ammonia. The frequency at which the absorption coefficient is maximum is obtained from graphs of the coefficient against pressure. Abstract of an Amer. Phys. Soc. paper.

621.396.615.17 **1337**

A New Pulse Generator Circuit [useful for ionosphere sounding].—Banerjee. (*See* 1210.)

RECEPTION

621.394/.397].813 **1338**

Defining Distortion.—M. G. Scroggie. (*Wireless World*, March 1946, Vol. 52, No. 3, pp. 99–100.) A letter criticizing the following definitions in the British Standard Glossary of Terms used in Telecommunication:— 1301 Distortion; 1302 Attenuation Distortion; 1304 Delay Distortion; 1305 Non-Linear Distortion; 1307 Harmonic Distortion; 1308 Intermodulation Distortion.

621.396.61/.62 + 621.395.645 **1339**

Low Power Transmitting/Receiving/and Hailing Equipment. Type CNY.1.—Morcom. (*See* 1386.)

621.396.62 : 621.396.662 **1340**

A Simple Remote Tuning Device for Receivers.—E. L. Hannum, Jr. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 76..82.) Band-spread about a selected communication frequency is achieved by varying the grid bias of a reactor valve connected across the tuned circuit of the receiver local oscillator, using a d.c. line circuit with remote potential-divider control. The control line is also used to carry the receiver a.f. output to the control point. The system is useful when it is necessary to locate a receiver perhaps several miles from the control centre in order to avoid noise interference with reception.

621.396.621 : 621.317.76 **1341**

Laboratory Receiver.—Frankart. (*See* 1293.)

621.396.621.54 **1342**

Practical Radio Course: Part 40.—A. A. Ghirardi. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 57 .. 151.) "The effects [and causes] of resonant frequency "drifts" in the preselector, i.f. amplifier, and oscillator tuning circuits of a superheterodyne-type receiver."

621.396.621.54 **1343**

Amateur Communication Receiver.—H. B. Dent. (*Wireless World*, Feb. 1946, Vol. 52, No. 2, pp. 36–40.) The basis of the design of a short-wave superheterodyne receiver with two frequency conversions. The conversion is firstly to 1.8 Mc/s, secondly to 100 kc/s, giving good second channel and adjacent channel selectivity. The circuit diagram is given.

621.396.621.59 **1344**

Discriminating between Signals of Different Amplitude.—E. H. Ullrich. (*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, pp. 120, 170.) "A method which permits the separation of pulse modulated waves where the frequency and the energy at the receiver may be identical, but the amplitude and/or duration are different." Summary of U.S. Patent 2 381 847.

621.396.621.59 **1345**

"Exalted-Carrier Amplitude- and Phase-Modulation Reception".—M. G. Crosby. (*Proc. Inst. Radio Engrs, N.Y.*, Feb. 1946, Vol. 34, No. 2, p. 90.) Discussions of 3516 of 1945.

621.397.8 **1346**

Television for Urbanized Areas [siting of aerials].—Duvall. (*See* 1384.)

STATIONS AND COMMUNICATION SYSTEMS

621.396.619 **1347**

Phase and Frequency Modulation.—E. Green. (*Marconi Rev.*, Oct./Dec. 1945, Vol. 8, No. 79, pp. 113–118.) Vector diagrams are used to show the relationship between phase and frequency modulation, and to derive the relative gain in signal/noise ratio of these types of modulation over amplitude modulation for various values of modulation index.

621.396.619 : 621.385.5 **1348**

Phasitron Converts from AM to FM Directly.—(*See* 1405.)

621.396.619.018.41 **1349**

Frequency Modulator.—D. A. Bell. (*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, pp. 118, 120.) When two signals at different frequencies are applied to a limiter, one component of the output has a frequency intermediate between the input frequencies, dependent on the relative amplitude of the inputs. Thus if one input is amplitude modulated, this output component is correspondingly frequency modulated. Summary of U.S. Patent 2 384 789.

621.396.619.16 **1350**

Pulse Position Modulation Technic.—(*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, pp. 82..190.) A detailed general technical account of the Bell system described in 740 of March, including block diagrams and some circuit diagrams of the equipment.

621.396.619.16 **1351**

Pulse Modulation.—F. F. Roberts & J. C. Simmonds. (*Wireless Engr*, March 1946, Vol. 23, No. 270, p. 93.) Suggested definitions and abbreviations for terms used in the various forms of pulse modulation. Sharp leading and trailing edges are assumed. See also 1053 of April (Cooke) and 183 of January (Roberts & Simmonds).

621.396.619.16 **1352**

Pulse-Time Modulation: An Explanation of the Principle.—(*Wireless World*, Feb. 1946, Vol. 52, No. 2, pp. 45–46.)

621.396.65.029.62/.64 **1353**

The [U.S.] Army's Radio Relay Equipment.—A. R. Boone. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 25..155.) The AN/TRC-1 is an f.m. set transmitting at 70–100 Mc/s from a double-H aerial, providing four telephone channels. The AN/TRC-8 is similar but operates at 230–250 Mc/s, using a dipole with a V-reflector. The AN/TRC-6 (4 300–4 900 Mc/s) uses eight interlaced pulse-position-modulated channels. The aerial is a parabolic reflector with waveguide feed. The AN/TRC-5 is similar, but uses a dipole with paraboloid reflector (1 350–1 450 Mc/s.). Advantages over wire circuits include reduction in installation time, and in the number of repeater stations needed. For descriptions of AN/TRC-5 and AN/TRC-6 see 1055/1056 of April and back references.

621.396.7 **1354**

The [U.S.] Signal Corps on and in the Air.—C. E. Jackson. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 94..98.) A complete airborne radio station to meet the speed, mobility and power required in Pacific operations was prepared, using three cargo planes. The 3-kW transmitter and

15-kW diesel generator were carried in separate planes, parked nose to nose, with a 38-ft horizontal aerial using the aircraft as counterpoise. The receiver plane, some half mile away, was linked by land line. A two-tone teletype system was used.

621.396.712 **1355**

FM in Canada.—D. Holloway. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 30..140.) An account of controversial problems of broadcasting policy.

621.396.82 : 621.396.9 **1356**

Radar Countermeasures.—D.G.F. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 92–97.) Description of methods of searching for, locating and jamming enemy radars. Wide-range automatically tuned receivers with tape recording and an oscillographic analyser are used for searching. Jamming is provided by tunable high-power transmitters having random-noise modulation, or by reflecting foil strips of suitable length (" window " or " chaff "). Wide-band aerial systems and the resnatron (a tetrode giving 30 kW c.w. at 500 Mc/s) are briefly described. The more commonly used equipment is described in tabular form. See also 1059/1061 of April.

621.396.931.029.62 **1357**

Multi-Carrier Communication System : Diversity Transmission for Mobile Working.—(*Wireless World*, Feb. 1946, Vol. 52, No. 2, pp. 59–61.) General description of a system used by the London police and fire services. Reliable two-way telephone communication with mobile units can be maintained over a service range of 20 miles using amplitude modulation, and frequencies near 100 Mc/s, with a 400–500 ft mast at the control centre. The service area is extended by using additional fixed stations, supplied with synchronized and correctly phased modulation, operating at frequencies sufficiently close to one another to be within the bandwidth of the receivers, but sufficiently far apart to avoid audible beats. Signals from the mobile transmitters can be received at any of the fixed stations and relayed to the control centre. The system is described in detail in an I.E.E. paper by J. R. Brinkley, not yet printed.

621.396.931.029.63 **1358**

2,660-Mc Train Communication System.—E. A. Dahl. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 118–122.) A description of a two-way f.m. system, for communication between front and rear of train, and from train to wayside stations. The equipment consists of two compact units, transceiver and power supplies. The 10-W transmitter uses a crystal-controlled oscillator, its frequency multiplied up to 2 660 Mc/s in five stages, the last by a klystron. The signal is then klystron-amplified and fed to the aerial. For reception, the same frequency-multiplying chain is used with a crystal of slightly different frequency to serve as local oscillator, which, mixed with the incoming signal, gives an i.f. of 7 Mc/s. The omni-azimuthal antenna consists of six vertically stacked units, each having three curved dipoles, arranged in a circle at the focus of a biconical parabolic reflector.

621.396.97 : 356.251.11 **1359**

Listening to the World.—C. Cross. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 64..141.) A non-technical review of the B.B.C.'s wartime monitoring service. See also 197 of January.

621.396 : 629.13 **1360**

Aviation Radio. [Book Review]—Roberts. (*See* 1256.)

SUBSIDIARY APPARATUS

539.16.08 **1361**

Experiments with Triode [particle-] **Counters.**—S. A. Korff. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 284.) Abstract of an Amer. Phys. Soc. paper.

621–526 **1362**

Electrical Analogy Methods Applied to Servomechanism Problems.—G. D. McCann, S. W. Herwald & H. S. Kirschbaum. (*Trans. Amer. Inst. elect. Engrs*, Feb. 1946, Vol. 65, No. 2, pp. 91–96.) The treatment of angular position mechanisms and a description of the transient analyser are given, with typical transient response curves. Effects of varying controlling parameters are shown.

621.314.634 : 621.396 **1363**

Dry-Contact Rectifiers for Radio Applications.—G. Herbert. (*Radio, N.Y.*, Dec. 1945, Vol. 29, No. 12, pp. 29..61.) Details of construction and performance of selenium rectifiers, including efficiency, regulation and current characteristics. A chart shows sizes and current capacity of rectifier plates.

621.314.67 **1364**

Capacitor-Charging Rectifier.—H. J. Bichsel. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 123–125.) Experimental determination of design criterion for a reactance-limited rectifier required to charge a large capacitor bank in the shortest time and with the least power demand on the mains. The capacitor normally charges rapidly until the charging pulses become discrete, and then the charge rate falls. This point, when $E \approx 0.63E_{max}$, is the most economical point at which to discharge.

621.316.722.1.078.3 **1365**

Electronic A-C Voltage Regulator.—L. D. Harris. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 150–151.) The d.c. output from a rectifier is compared with the potential drop across a stabilizing tube. The difference is used to alter the d.c. load on another rectifier system with its transformer primary in series with the mains. The change of reactance of this winding reduces the fluctuations at the mains output terminals to about 6% of their original value. Third-harmonic content of the supply is also reduced.

621.316.722.1.078.3 **1366**

Stabilized D-C High-Voltage Supply.—A. M. Gurewitsch & P. C. Noble. (*Gen. elect. Rev.*, Dec. 1945, Vol. 48, No. 12, pp. 46..52.) The supply was designed for an electron diffraction instrument. A 35-kc/s power oscillator output is amplified, transformed to 15 kV and rectified by means of a voltage-quadrupling circuit to give 60 kV with an output of 60 W. The filaments of the rectifiers and also the filament of the electron gun are each supplied from separate 250-kc/s power oscillators. Automatic regulation is obtained by applying some of the output voltage to the screen of the driving oscillator. A 10% change in input voltage, or a load varying from 0.5 to 1.0 mA, causes the output voltage to vary less than 0.1%. The a.c. ripple is about 0.05%.

621.316.722.1.078.3 **1367**

A Voltage Regulator for X-Ray Circuits.—W. P. Davey. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 285.) Changes in the rectified mains voltage operate a relay train to a motor which moves the field rheostat of a 20-kVA alternator in the appropriate direction. The a.c. voltage is regulated to ±0.02 V in 110 V. Abstract of an Amer. Phys. Soc. paper.

621.317.083.7 + 621.398 **1368**

New Power Operated Sensitive [meter] **Recorder.**—P. G. Weiller. (*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, pp. 88..140.) Contact of the meter pointer with one of two graphite blocks starts a motor, through a triode and relay, which moves the block away from the pointer, and simultaneously operates a means of remote indication or control. Precautions taken avoid hunting, sticking of contacts, or interruption of operation by electrostatic forces or absorbed gases on the contacts. Any meter with a torque of 0.02 gm.cm or more for full-scale deflexion may be used.

621.318.42.029.6 **1369**

R.F. Chokes at U.H.F.—W. J. Stolze. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 54..114.) Chokes should have very high impedance at the working frequency, sufficiently low resistance, and the wire should have sufficient current-carrying capacity. Choke connexions should be as short as possible. A design chart gives recommended numbers of turns for frequencies from 40–160 Mc/s. Examples of uses for chokes are given, and the use of transmission lines as chokes is mentioned.

621.384.6 **1370**

100 Million Volt Electron Accelerator.—(*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, pp. 90..168.) An account of the device described in 438 of February (Westendorp & Charlton).

621.386 (091) **1371**

X-Ray History and Development.—W. D. Coolidge & E. E. Charlton. (*Elect. Engng, N.Y.*, Dec. 1945, Vol. 64, No. 12, pp. 427–432.) See 770 of March. This paper also appears in *Radiology*, Dec. 1945.

621.386(4) **1372**

50 Years of X-Ray Progress in Europe.—J. H. van der Tuuk. (*Elect. Engng, N.Y.*, Dec. 1945, Vol. 64, No. 12, pp. 444–448.)

621.398 : 621.318.5 **1373**

Industrial Relay Control Circuits.—Batcher. (*See* 1321.)

621.398 : 621.396.662 **1374**

Automatic Positioning Control Mechanisms.—R. W. May & N. H. Hale. (*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, pp. 58..158.) A review of types of mechanisms suitable for rapid readjustment of the controls of multifrequency transmitters. The Collins Autotune is described in detail.

621–526 **1375**

Fundamental Theory of Servomechanisms. [Book Review]—L. A. MacColl. D. Van Nostrand, New York, $2.50. (*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, p. 163.) " It is scholarly and will well repay the expert or would-be expert for its study."

TELEVISION AND PHOTOTELEGRAPHY

621.383.8 **1376**

High Sensitivity Pickup.—(*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, pp. 88–89.) A short account of the R.C.A. Image Orthicon, a television camera tube about 100 times more sensitive than previous instruments. Electrons are emitted from a photoelectric screen, and are attracted electrostatically to a non-conducting target, where they cause the emission of secondary electrons, leaving a pattern of positive charges corresponding to the original light image. The back of the target is scanned by an electron beam that has just enough energy almost to reach the screen before being turned back to the gun by the electrostatic forces. When the beam scans a part of the target that is positively charged, sufficient electrons are attracted from the beam to neutralize the charge, leaving the returning beam correspondingly deficient. The returning beam is therefore modulated according to the electrical pattern on the target. It strikes the front of the electron gun, causing the emission of secondary electrons that are attracted by the plates of an electron multiplier from which the output is obtained. For another account see *Electronics*, Dec. 1945, Vol. 18, No. 12, p. 330.

621.385.832 **1377**

Phosphors and Their Behaviour in Television [parts I & II].—Krushel. (*See* 1272/1273.)

621.397 **1378**

[U.S.] **Industry Standardization Work in Television.**—D. B. Smith. (*Electronic Industr.*, Dec., 1945, Vol. 4, No. 12, pp. 192, 194.) A brief survey of proposals for further standardization of the television service on the lower frequency range of operation. Reference is made to three-dimensional colour television. Summary of an I.R.E. paper. See also *Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 244..246.

621.397 : 535.317 **1379**

[Optical] **Lens Aberrations in Picture Projection.**—A. Montani. (*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, pp. 86, 87, 150.) Qualitative description of six types of aberration which should be corrected in television equipment.

621.397 : 621.396.619.1 **1380**

Amplitude Modulator for Facsimile.—Artzt. (*See* 1390.)

621.397.3 : 621.396.615.17 **1381**

Television Sweep Oscillators.—E. M. Noll. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 52..74.) The basic theory of sawtooth voltage generators, including the multivibrator, blocking oscillator, and gas-discharge oscillator. Part II of a series beginning with 782 of March.

621.397.5 : 621.396.619.16 **1382**

Transmission of Television Sound on the Picture Carrier.—G. L. Fredendall, K. Schlesinger & A. C. Schroeder. (*Proc. Inst. Radio Engrs., N.Y.*, Feb. 1946, Vol. 34, No. 2, pp. 49–61.) A discussion of duplex transmission using several types of pulse modulation. " The advantages of duplex transmission are : (1) elimination of a separate sound transmitter, (2) elimination of the ambiguity and difficulty which may occur when a standard frequency-modulated sound signal is tuned in, (3) freedom of the audio output from the type of distortion which occurs in frequency-modulated receivers as a consequence of excessive drift of the frequency of the local oscillator, and (4) improvement of the phase characteristic of the picture intermediate-frequency amplifier resulting from elimination of trap circuits.

" With the exception of pulsed frequency modulation, the signal-to-noise ratios of sound in duplex systems are not so great as the ratio offered by the transmission of a standard frequency-modulated carrier. The comparison is subject to the condition that the amplitude of the frequency-modulated carrier is 0.7 of the peak amplitude of the duplex carrier. The signal-to-noise ratio of a pulsed frequency-modulated signal may equal the ratio of a standard frequency-modulated signal up to a critical distance from the transmitter, but is less at greater distance."

621.397.62 **1383**

Television Psychology : Is the Large Screen Essential ?—P. Bellac. (*Wireless World*, Feb. 1946, Vol. 52, No. 2, p. 40.) A small, close object may subtend the same angle at the eye as a large object seen from a distance, but the convergence of the eye axes in viewing the close object gives an impression of nearness and therefore of smallness. An unpleasant impression is produced by the discrepancy between the smallness of the image and the intensity of the sound. These faults can be overcome only by a television receiver with a projection system giving an image size comparable with that of home moving pictures.

621.397.8 **1384**

Television for Urbanized Areas.—G. Duvall. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 88..92.) There is no ready-made solution for the best siting of television aerials, when line of sight reception is impossible. Due to reflections from physical barriers, the proper orientation of the dipoles is a matter of experiment. Maximum height consistent with feeder cable cost is an over-all aim.

TRANSMISSION

621.385.3.029.63 : 621.396.615.16.029.63 **1385**

A Vacuum-Contained Push-Pull Triode Transmitter [Type VT158].—Zahl, Gorham & Rouse. (*See* 1403.)

621.396.61/.62 + 621.395.645 **1386**

Low Power Transmitting/Receiving/and Hailing Equipment. Type CNY.1.—W. J. Morcom. (*Marconi Rev.*, Oct./Dec. 1945, Vol. 8, No. 79, pp. 119–124.) This transportable equipment has facilities for telephony and telegraphy transmission, reception and hailing. The transmitter power is 5–8 W on 1.5–9 Mc/s. The receiver gives an output of 3.5 W and the a.f. power input to the hailing loudspeaker is 10 W.

621.396.61 : 621.396.619.018.41 **1387**

Concentric Line [88–108 Mc/s band] **FM Transmitter for 250 W.**—(*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, pp. 78..146.) Description of a Transmitter Equipment Mfg. Co. equipment. Use of miniature valves and push-pull circuits reduces problems of frequency multiplication, stability, and modulation. Electro-mechanical tuning maintains the frequency relative to a crystal-controlled oscillator.

621.396.61.029[.58 + .62 **1388**

Unusual Transmitter for 28-54 Mc/s.—R. P. Turner. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 40..126.) Constructional details of a 30-W transmitter, continuously tunable throughout the frequency band, with provision for crystal control. The controlled oscillator works on the fundamental or second harmonic of a crystal with frequency about 7 Mc/s. The frequency is quadrupled in the driver stage. Use of a dual beam tetrode, type 815, link-coupled to the driver stage, avoids the necessity for neutralization.

621.396.615.12 **1389**

Transitron Oscillator for High Stability.—W. Muller. (*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, pp. 110..138.) An oscillator to cover the range 40–175 kc/s with a stability of ± 4 c/s between −40°C and 60°C, and for line voltage variations of ± 25% was required. Of three types considered (including phase-shift and electron-coupled oscillators), the transitron oscillator best fulfilled the requirements. A detailed description is given of the design of the circuit and of the experiments on which it was based.

621.396.619.1 : 621.397 **1390**

Amplitude Modulator for Facsimile.—M. Artzt. (*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, p. 172.) A method of modulating a wave from an RC-coupled oscillator at the maximum possible keying rate, with freedom from transients. Summary of U.S. Patent 2 373 737.

VALVES AND THERMIONICS

537.525 **1391**

Small Perturbations of the Electric Discharge.—Granovsky. (*See* 1224.)

537.533.8 **1392**

Erratum : Secondary Emission of Pyrex Glass.—C. W. Mueller. (*J. appl. Phys.*, Jan. 1946, Vol. 17, No. 1, p. 62.) Correction to the composition of the glass quoted in 3648 of 1945 (Mueller).

621.38(083.72) **1393**

The Tron Family.—W. C. White. (*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, pp. 80..136.) A glossary of names of valves and other electronic devices having the suffix "tron", with bibliographic references to early use of the words.

621.385 + 621.396.615 + 538.561 **1394**

Interchange of Energy between an Electron Beam and an Oscillating Electric Field.—J. Marcum. (*J. appl. Phys.*, Jan. 1946, Vol. 17, No. 1, pp. 4–11.) " Relations between various parameters are obtained which describe the behavior of an accelerated electron beam which is caused to traverse an alternating electric field. In particular, a mechanicographical means for obtaining the gain or loss of energy is described. It is shown that under the most favorable conditions a maximum of 17 per cent. of the energy in the accelerated beam may be transferred to the alternating field. Application of these principles to a type of ultra-high frequency oscillator is treated."

621.385 **1395**

Physical Limitations in Electron Ballistics.—J. R. Pierce. (*Bell. Syst. tech. J.*, July/Oct. 1945, Vol. 24, Nos. 3/4, pp. 305–321.) Mainly a consideration of devices with large beam currents, dealing with the following points. Electron lens aperture; distribution of initial velocities of electrons; space-charge effects; power-dissipation limits, and effect of scaling down electron devices.

621.385 **1396**

Electron Ballistics in High-Frequency Fields.—A. L. Samuel. (*Bell. Syst. tech. J.*, July/Oct. 1945, Vol. 24, Nos. 3/4, pp. 322–352.) The five fundamental functions of an electronic device are—production of an electron beam, modulation of the beam, conversion of this modulation into a usable form, abstraction of energy from the beam, and collection of spent electrons. Conversion mechanisms in which electrons are sorted according to velocities and the " bunching " of electrons as used in magnetrons, Barkhausen tubes, diode oscillators and klystrons, are considered. The mathematical analysis of electron motions in the klystron is outlined, and diagrams given which illustrate graphically the bunching effect. The influence of space charge in modifying the bunching effect and electron paths within the magnetron is briefly discussed.

621.385 **1397**

Factors Determining Industrial Tube Life.—J. F. Dreyer, Jr. (*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, pp. 94..156.) Apart from mechanical defects and careless handling, the normal life of a valve depends solely on the rate of cathode emission. A curve showing the relationship between emission and expected life is given, followed by a detailed discussion on methods of obtaining optimum efficiency at minimum cost.

621.385 : 623.454.25 **1398**

Proximity Fuze Tubes.—M. A. Acheson. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 228..236.) Summary of an I.R.E. paper describing the special requirements and the expedients by which they were met.

621.385.029.64(43) **1399**

Germany's UHF Tubes.—Combined Intelligence Objectives Sub-Committee. (*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, pp. 81..122.) Describes construction and design principles of velocity-modulated and magnetron valves for c.w. and pulse operation on bands between 10 cm and 3.7 mm wavelength. Exploration of intense electron beams is made with pieces of carbonized paper which glow when inserted in the beam. Information taken from Combined Intelligence Objectives Sub-Committee reports, index nos. 58, 59, 69, 78 and 95.

621.385.1 **1400**

Reflex Oscillators Utilizing Secondary Emission Current.—C. C. Wang. (*Phys. Rev.*, 1st/15th Dec. 1945, Vol. 68, Nos. 11/12, p. 284.) To increase the power output of velocity-modulated tubes, a secondary-emission electrode is introduced to increase the beam current delivered to the gap where h.f. energy is absorbed from the beam. The tubes have been successfully operated at 4 000 Mc/s. Abstract of an Amer. Phys. Soc. paper.

621.385.16.029.63/.64 **1401**

Cavity Magnetrons.—D. G. F. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 126–131.) Details of the development and construction of centimetric-wave tubes used for radar. A list of types developed for pulsed operation in the L-band (25–50 cm), S-band (8–11 cm), and X-band (3 cm) is given, with the power and duty-cycle ratings. Efficiency, undesired modes, magnet construction, and output matching are discussed. The Rieke diagram showing the effect of load impedance on output power and frequency of a typical magnetron is given. Peak powers up to and beyond a megawatt have been obtained.

621.385.16.029.63/.64 **1402**

Theory of Magnetron Tubes and Their Uses.—H. G. Shea. (*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, pp. 66–70.) A simple derivation of cavity magnetron theory, with discussion of the results and of application to the construction of standard types. Particular reference is made to mode stability and to the " strapping " of alternate barriers. Frequency/power (Rieke) diagrams, and typical operating conditions are given for the 4J36–4J41 type.

621.385.3.029.63 : 621.396.615.16.029.63 **1403**

A Vacuum-Contained Push-Pull Triode Transmitter [Type VT158].—H. A. Zahl, J. E. Gorham & G. F. Rouse. (*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 66–69.) The resonating grid and plate circuits are contained in the vacuum and form integral parts of the grid and plate structures. The tube is used with a tuned filament line. It can oscillate in a narrow frequency band between 200 and 700 Mc/s. It will give 200–300 kW pulsed peak powers, and can also be used for c.w.

621.385.5 : 539.16.08 **1404**

Use of 6AK5 and 954 Tubes in Ionization Chamber Pulse Amplifiers.—V. L. Parsegian. (*Rev. sci. Instrum.*, Jan. 1946, Vol. 17, No. 1, pp. 39–40.) Results based on tests to obtain high signal/noise ratio with floating grid and with very high grid leak operation.

621.385.5 : 621.396.619 **1405**

Phasitron Converts from AM to FM Directly.—(*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, pp. 78–79.) A horizontal circular disk of electrons from the cathode of the phasitron is modulated at the crystal-controlled carrier frequency by a grid system that bends the electron trajectories in a vertical direction so that the edge of the electron sheet follows a line that is sinusoidal in the vertical direction. The grid system is composed of a number of similar elements equally spaced around the vertical axis so that there are several wavelengths of vertical modulation around the complete electron sheet. Also, each grid element is threefold and fed with a three-phase voltage so that the modulation profile of the sheet rotates about the vertical axis. There is a coaxial cylindrical screen around the sheet, with holes punched in it at equi-angular intervals, through which, on account of the rotation of the fluted electron sheet, are projected streams of electrons that vary in intensity at the carrier frequency. A coil of wire coaxial with the electron sheet carries a.f. current and produces an alternating magnetic field that deflects the electron trajectories in a circumferential direction, and consequently phase-modulates the streams of electrons passing through the holes in the screen. An anode outside the screen collects the projected electrons and therefore carries a current alternating at the carrier frequency and phase-modulated at the audio frequency. ∎

621.385.5 : 621.396.621.54 **1406**

Recent Developments in Converter Tubes.—W. A. Harris & R. F. Dunn. (*Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 240..242.) Description of the 6SB7Y converter which has a conversion transconductance of 0.95 mA/V, and an oscillator transconductance of 8 mA/V. It is said to give improved gain and signal/noise ratio in the medium- and short-wave bands. Some details of operation around 100 Mc/s are given. Summary of an I.R.E. paper. See also *Electronic Industr.*, Dec. 1945. Vol. 4, No. 12, p. 81.

621.385.831 : 621.396.619.018.41 **1407**

Ratio-Controlled Amplifier.—C. W. Hansell. (*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, p. 120.) An amplifier tube intended for use with a balanced discriminator, avoiding the necessity of a limiter in frequency- or phase-modulation detector circuits. Summary of U.S. Patent 2 383 855.

MISCELLANEOUS

001.8 : 62 **1408**

A Plea for the Scientific Method.—L. Hoffer. (*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 56–57.) The importance of critical discrimination, proper classification of data, scientific technique and pure research in engineering are outlined.

001.89 **1409**

Science and the Government.—H. M. Kilgore. (*Science*, 21st Dec. 1945, Vol. 102, No. 2660, pp. 630–638.) Discussion of a proposal to set up a National Scientific Research Foundation in the U.S.A., in the form of a government agency, dealing with research into all problems related to national welfare.

001.891 : 6(410) **1410**

Alliance of Industry and Scientific Research in Great Britain.—B. J. A. Bard. (*Science*, 4th Jan. 1946, Vol. 103, No. 2662, pp. 6–8.) Present plans for closer liaison include endowments and scholarships to be offered to the universities by industry, interchange of staff, and joint research councils.

519.283 **1411**

Statistical Methods in Quality Control—VII.—A.I.E.E. Subcommittee on Educational Activities. (*Elect. Engng, N.Y.*, Dec. 1945, Vol. 64, No. 12, pp. 448–450.) The use of control charts and the analysis of samples in a manufacturing process, to determine factors which might need correction. For previous parts see 805 of March. See also 1412 below.

519.283 **1412**

Statistical Methods in Quality Control—IX.—A.I.E.E. Subcommittee on Educational Activities. (*Elect. Engng, N.Y.*, Feb. 1946, Vol. 65, No. 2, pp. 81–83.) Discussion of acceptance sampling based on the method of attributes, including single sampling, double sampling, and multiple sampling. The "operating characteristics" are plotted to compare the various methods. See also 1411 above.

62 **1413**

Progress Depends on Sound Engineering.—J. A. Stobbe. (*Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, pp. 72–73.) Emphasizes the need for close contact between engineer and consumer, and for designing for reduction of production costs.

621.3.012.3 : 621.3.081.4 **1414**

Decibel Conversion Chart.—Miedke. (*See* 1281.)

621.3.085.6 + 621.3.017.72 **1415**

Heat Dissipation from Cabinets for Electrical Instruments.—H. C. Littlejohn. (*Gen. Radio Exp.*, Jan. 1946, Vol. 20, No. 8, pp. 4–5.) A table is given showing the relative heat-dissipation properties of various materials. The most efficient dissipator is a metal case with an internal and external dull black finish.

621.38 : 621.317.2 **1416**

A Laboratory for Basic Electronics.—P. M. Honnell & W. E. Strohm. (*Elect. Engng, N.Y.*, Feb. 1946, Vol. 65, No. 2, pp. 75–80.) A description of the 140-position electronics laboratory installed at the U.S. Military Academy. A central switchboard distributes alternating or direct voltage, including a.f. and r.f. up to 18 Mc/s, to any of twelve benches, each of which has several student positions equipped with its own switchboard. Protective measures include automatic isolating of small sections to facilitate fault tracing.

621.394/.395].653 + 531.4 + 539.62 **1417**

The Physics of Rubbing Surfaces.—Bowden. (*See* 1219.)

621.396/.397](058.7) **1418**

1945 Electronic Engineering Directory.—(*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12.) A 56-page directory of U.S. sources of supply of radio and allied equipment. A supplement giving names of patent attorneys and consulting engineers appears in *Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, pp. 98, 100.

621.396.62.017.72 **1419**

Ventilation Problems.—W. Tusting. (*Wireless World*, March 1946, Vol. 52, No. 3, pp. 72–75.) Suggests that the need for dissipating the heat (60–200 W) generated by radio receivers is not always given due consideration in the early design stage. Excessive temperature rise may reduce component life. It is also liable to cause considerable frequency drift. The provision of unimpeded channels for air-flow around valves is the chief recommendation.

621.396.9 : 061.6 **1420**

History and Activities of the Radiation Laboratory of the Massachusetts Institute of Technology.—DuBridge. (*See* 1251.)

621.38 **1421**

Electronics for Engineers. [Book Review]—J. Markus & V. Zeluff (Eds.). McGraw-Hill Book Co., New York, 1945, 390 pp., $6. (*Elect. Engng, N.Y.*, Feb. 1946, Vol. 65, No. 2, p. 98.) A collection of 142 articles, reference sheets, charts and graphs reprinted from *Electronics*.

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534.21 **1422**

Propagation of Sound Waves in a Liquid Layer between Two Absorbing Half-Spaces.—L. M. Brekhovskikh. (*C. R. Acad. Sci. U.R.S.S.*, 1945, Vol. 48, No. 6, pp. 397–400. In English.) Theoretical analysis of a problem in sound wave propagation which "may find application in geophysics (propagation through an oil layer), in architectural acoustics and in hydroacoustics (propagation of sound through the sea)".

534.213 : 621.395.623.7 **1423**

Wave Propagation and Outdoor Field Tests of a Loudspeaker System.—F. L. Hopper & R. C. Moody. (*J. Soc. Mot. Pict. Engrs*, Feb. 1946, Vol. 46, No. 2, pp. 115–123.) Propagation tests at frequencies between 100 c/s and 8 kc/s are described, indicating an inverse square law attenuation up to a distance of 400 wavelengths for heights of transmitter and receiver of 7½ ft and 3 ft respectively. The effects of snow, wind and pressure are also discussed.

534.321.9 : 620.179 **1424**

Supersonic Inspection of Strip Materials.—(*Electronics*, March 1946, Vol. 19, No. 3, pp. 166..170.) See also 1149 of May.

534.41 + 534.781 **1425**

Visible Speech.—R. K. Potter. (*Bell Lab. Rec.*, Jan. 1946, Vol. 24, No. 1, pp. 7–11.) An account in general terms of the system described in 823 of April.

534.43 **1426**

Spotting and Repeating Record Player.—R. H. Bailey. (*Radio News*, Feb. 1946, Vol. 35, No. 2, pp. 29..128.) Brief general account of a device to enable accurate location of any particular passage on a disk record, and to enable the accurate setting of the pickup to repeat any passage of which the position has been noted.

534.6 : 621.395.623.7 **1427**

On the Maximum Possible Reinforcing of Sound under Outdoor Conditions : and in an Enclosure.—G. M. Suharevsky. (*C. R. Acad. Sci. U.R.S.S.*, 1940, Vol. 26, No. 9, pp. 885–891, 892–899. In English.) The degree of "sound reinforcing" is defined as 10 log (I_a/I_o) where I_a is the average level of intensity at the point of audition and I_o is the average level of intensity at the microphone. This quantity is limited by acoustical feedback, and by associated frequency distortion. Very detailed formulae are given, depending on the polar diagram and location of the loudspeaker and the constants of the boundaries of the sound field. The acoustic feedback limitation is very severe in an enclosure. One means of raising the possible level of reinforcement is to "mix up" the standing wave systems by revolving the loudspeaker so that its axis describes a cone ; or by means of a revolving screen in the horn or at the mouth of the loudspeaker. A gain of 6–8 db can be realized in this way.

534.62 : 061.6 **1428**

Acoustic Laboratory.—(*Electronic Industr.*, March 1946, Vol. 5, No. 3, p. 78.) Description of the Harvard "Anechoic Chamber": reflection coefficient at walls 0.1%. Development of sound insulating assemblies: investigation of speech intelligibility at high altitudes. See also 1429 below.

534.62 : 061.6 **1429**

Achievements of Harvard's Electro-Acoustic Laboratory.—(*Electronics*, March 1946, Vol. 19, No. 3, pp. 312..323.) A review of the work done in sound-proofing aeroplane cabins and in improving the system of communications between the members of the crew ; includes a description of the construction of an echo-free room. See also 1428 above.

534.845 : 677.521 **1430**

Forms, Properties and Functions of Fibrous Glass Acoustical Materials.—W. M. Rees. (*Communications*, Jan. 1946, Vol. 26, No. 1, pp. 36, 38.) The materials are provided as wool, blankets, etc., or bonded with resin to form boards. A table gives absorption data. Graphs show that for layers of wool, etc., up to about 2 inches thick the absorption increases equally with density throughout the frequency spectrum. At greater thicknesses absorption is little affected by density at frequencies above 500 c/s. Encasing boards in paint, cellophane, etc., causes a small increase in absorption at low frequencies and a large decrease at high frequencies. See also 1156 of May (Rees & Taylor).

534.88 + 621.395.625.3 **1431**

I.R.E. Winter Technical Meeting January 1946.—(*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 80..93.) Abstracts are given of the following papers read at the meeting. Magnetic Recorder as an Adjunct to the Home Receiver.—S. J. Begun (Title only). Basic Principles of Underwater Sound-Equipment Design.—R. Bennett. For other abstracts, see *Electronics*, March 1946, Vol. 19, No. 3, pp. 92..108, and *Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 62..74. For titles of other papers read, see other sections.

534.88 : 533.6.013.22 **1432**

On the Propagation of Sound in Turbulent Atmosphere.—V. Krassilnikov. (*C. R. Acad. Sci. U.R.S.S.*, 1945, Vol. 47, No. 7, pp. 469–471. In English.) The phase fluctuations of a sound wave propagated in a turbulent atmosphere are calculated, and applied to the problem of locating a source of sound by spaced microphones. The inaccuracy of sound rangers in conditions of strong wind is attributed to the effect of turbulence on the mean velocity of sound along the path.

621.395.42 : 534.7 **1433**

Infrasonic Switching.—Montani. (*See* 1667).

621.395.614 **1434**

A Unidirectional Crystal Microphone.—A. M. Wiggins. (*Communications*, Jan. 1946, Vol. 26, No. 1, pp. 20–22.) A unidirectional microphone is obtained by placing a damped, dead diaphragm of correct mechanical impedance behind the crystal. The formulae for calculating the correct resistance and mass of this diaphragm are given. The response rises at the rate of 6 db per octave, and this is counteracted by an RC filter of complementary characteristics.

621.395.615 **1435**

Electronic Microphone.—J. Rothstein. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 230..232.) A flexible diaphragm is mechanically coupled to the grid of a parallel-plane electron tube. Motion of the diaphragm changes the position of the grid relative to the anode and cathode and so changes the amplification factor of the valve. Summary of U.S. Patent 2 389 935.

621.395.623.7 : 621.392.53 **1436**

Reduction of Loudspeaker Distortion.—F. C. Jones. (*Radio, N.Y.*, Jan. 1946, Vol. 30, No. 1, pp. 26–28.) Harmonic distortion at low frequencies, which is serious at high inputs, arises from the low resonant frequency of the moving-coil system. It may be substantially reduced by using a "bass reflex" cabinet enclosure with an air vent adjacent to the speaker cone. High-frequency distortion, arising from frequency modulation of the high frequencies by a low frequency, may be reduced by using two speakers in a dual system, one for the high and the other for the low frequencies. The design of cross-over filter networks for use in such a system is discussed and practical constructional data are given. The circuits described are for 6-ohm speech coils and give cross-overs at about 1 500 c/s. See also 529 of March.

621.395.623.75 **1437**

Design of Compact Two-Horn Loudspeaker.—P. W. Klipsch. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 156–159.) "For room-corner locations, where walls can be utilized to produce reflections that multiply the mouth area of the woofer sufficiently for efficient propagation of sound waves down to 40 c/s. Companion tweeter gives wide-angle radiation." Based on 830 of April (Klipsch) and back references.

621.395.623.8 **1438**

Massive Speaker Cabinet.—C. A. Volf. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 206..214.) Another account of the system described in 531 of March and 1162 of May.

621.395.623.8 **1439**

High-Power Military Sound Systems.—(*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 216..222.) An outline of the device described in 532 of March, and of a giant loudspeaker system installed in a bomber, for addressing an entire city from the air.

621.395.645 **1440**

Hi-Fi Amplifier Contest.—J. W. Straede. (*Radio Craft*, Jan. 1946, Vol. 17, No. 4, pp. 249..272.) Details of the four best amplifiers in an Australian contest, limited to amateurs, in which the fidelity was judged by a public audience, and the technical details by a special panel.

621.395.92 **1441**

The Testing of Deaf Aids.—T. H. Turney. (*J. sci. Instrum.*, March 1946, Vol. 23, No. 3, pp. 58–59.) Describes the measurement of the gain by a two-voltmeter method and by an artificial ear method. Substantial agreement is obtained.

621.395.92 : 534.771 **1442**

Historic Firsts : The Audiometer.—(*Bell Lab. Rec.*, Feb. 1946, Vol. 24, No. 2, pp. 57–58.) An instrument for investigating hearing ability at any frequency between 30 and 16 000 c/s.

621.396.611.21 + 621.317.361 **1443**

Duplex Crystals.—Lane. (*See* 1582.)

621.396.97 **1444**

Radio Sound Effects. [Book Review]—J. Cramer & W. B. Hoffman. Ziff-Davis, New York, 1945, 71 pp., $1.50. (*Electronics*, Feb. 1946, Vol. 19, No. 2, p. 360.) "Not a text, but a syllabus of study for broadcasters, sound technicians . . . [it] makes no pretence of teaching its readers in one easy lesson."

AERIALS AND TRANSMISSION LINES

621.317.79 : [621.315.212.1.029.62/.63 **1445**

Measuring Coaxials at Ultra-High Frequencies.—Fleming. (*See* 1597.)

621.392 **1446**

The Capacity of Twin Cable—II.—J. W. Craggs & C. J. Tranter. (*Quart. appl. Math.*, Jan. 1946, Vol. 3, No. 4, pp. 380–383.) An extension of 660 of March (Craggs & Tranter) to the case in which the dielectric sheaths enclosing the two conductors are separated and surrounded by another dielectric medium. Two methods are given, leading to series solutions, one converging more rapidly than the other, according to the ratio of the dielectric constants of the two dielectrics involved.

621.392 **1447**

Waves and Wave Guides: Part III.—G.G. (*QST*, March 1946, Vol. 30, No. 3, pp. 61..134.) Nomenclature of modes of guided waves, and determination of cut-off frequencies. A practical consideration of guide dimensions for the amateur bands. For previous parts see 546 of March and 284 of February.

621.396.67 **1448**

I.R.E. Winter Technical Meeting January 1946.—(*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 80..93.) Abstracts are given of the following papers read at the meeting. Antenna for Frequency-Modulation Station WGHF.—A. Alford. Broad-Band Antennas and Direction-Finding Systems for Very High Frequencies.—A. Alford, J. D. Kraus, A. Dorne & J. Christensen. Metal Lens Antennas.—W. E. Kock. Design Considerations in Broadside Arrays. — J. Ruze. Ultra-High-Frequency Television Transmitters and Antennas.—R. Serrell. Model Aircraft-Antenna Measurements.—G. Sinclair, E. W. Vaughan & E. C. Jordan. Beam-Shaping Methods in Antenna Design.—L. C. Van Atta. Directional Couplers.—W. W. Mumford. From Wiring to Plumbing.—E. M. Purcell. Equivalent Circuits for Wave-Guide Structures.—J. Schwinger. For other abstracts see *Electronics*, March 1946, Vol. 19, No. 3, pp. 92..108, and *Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 62..74. For titles of other papers, see other sections.

621.396.67 **1449**

The Effective Length of a Half-Wave Dipole.—G.W.O.H. (*Wireless Engr*, April 1946, Vol. 23, No. 271, pp. 95–96.) The equivalence of a dipole with sinusoidal current distribution, and an aerial λ/π long carrying a uniform current equal to that at the centre of the dipole, is not exact for points off the equatorial plane, and the field deduced therefrom is shown to be up to 5 or 6% in error. See also 1802 of 1945 (G.W.O.H.).

621.396.67 **1450**

Some Experiments with Linear Aerials.—J. S. McPetrie & J. A. Saxton. (*Wireless Engr*, April 1946, Vol. 23, No. 271, pp. 107–114.) A method of determining the polar diagram of a linear aerial based on the summation of the effect of current waves induced in the aerial by an incident electromagnetic field gives satisfactory agreement between theoretical and experimental polar diagrams for aerials an integral number of halfwaves in length. An experimental investigation of front-to-back ratios of a halfwave dipole and parasite shows that, as a reflector system, the optimum length and spacing of the parasite were 0.5 and 0.1 of the wavelength respectively, giving 11 db ratio, and as a director system, the corresponding values were 0.47 and 0.05, giving 20 db ratio.

621.396.67 **1451**

Antenna Construction.—A. Alford & M. Fuchs. (*Radio, N.Y.*, Jan. 1946, Vol. 30, No. 1, pp. 43, 58.) A dipole consists of two metal sleeves end to end, insulated from and surrounding a coaxial tubular metal mast which projects beyond the upper sleeve. The aerial is substantially balanced, and is fed from a transmission line carried through the interior of the mast. Summary of U.S. Patent 2 385 783.

621.396.67 : 621.396.82 **1452**

QRM—The Electronic Life Saver: Part II [Aerials for radar countermeasures].—Robbiano. (*See* 1527.)

621.396.671 **1453**

The Cylindrical Antenna: Current and Impedance.—R. King & D. Middleton. (*Quart. appl. Math.*, Jan. 1946, Vol. 3, No. 4, pp. 302–335.) A theoretical analysis of an idealized case, with premises similar to those postulated in earlier investigations (see Hallén, 2763 of 1939, and King & Harrison, 817 of 1944). The aim of the paper is solely analytical improvement of the solution of the problem. This has been achieved by introducing parameters different from those used by Hallén (*loc. cit.*) in order to fit the actual current distribution to an analytical form. A comparison of first-order solutions for the current distribution in Hallén's and the present work shows that "The new, more exact theory leads to a distribution with somewhat greater relative amplitudes nearer the outer parts of the antenna, and with a somewhat larger component in phase with the driving potential difference." The impedance, on the new theory, differs in detail but not in any major manner from that given by the previous work. In general, resistances are smaller at antiresonance, and are greater at resonance: these differences are most significant for large values of antenna radius. A comparison is made between the new theory and unpublished experimental determinations, by D. D. King, of the impedance characteristics of such an antenna. The agreement is good for all quantities in the second-order theory, but only approximate in the first order.

621.396.671 **1454**

The Efficiency of a Short Transmitting Antenna.—V. J. Andrew. (*Communications*, Jan. 1946, Vol. 26, No. 1, pp. 52–53.) The inefficiency of aerials of lengths less than 0.18 λ is due to the fact that they have a low radiation resistance and a large negative reactance, resulting in relatively high losses in the loading inductor. The adverse effect of the lead-in capacitance can be reduced by placing the loading inductor at the base of the aerial.

621.396.673 **1455**

The Quadrant Aerial.—N. Wells. (*Marconi Rev.*, Jan./March 1946, Vol. 9, No. 80, pp. 21–23.) This is a horizontal aerial system with an omnidirectional pattern. It can be used over a wide frequency band for both transmission and reception. The system comprises two aerials with figure-of-eight diagrams set at right angles to each other and in phase quadrature. The omnidirectional character is well maintained over a frequency range of 2 to 1, as is the vertical directivity pattern, which is governed by the height of the aerial. A group of four poles carrying four aerials can together cover the band 2–30 Mc/s.

621.396.677 **1456**

A Generalised Radiation Formula for Horizontal Rhombic Aerials.—H. Cafferata. (*Marconi Rev.*, Jan./March 1946, Vol. 9, No. 80, pp. 24–35.) Limitations of the earlier calculations of the radiated field are pointed out and a more general treatment is given. In particular, the positions where mixed polarized waves are received is considered, and account is taken of current attenuation in the conductors. "The source considered is that of a multiple array of horizontal rhombic elements arranged *n* in cascade and *m* cascades in parallel, and all contained in the same horizontal plane. The formula allows for arbitrary phase relations as between cascades and between elements in each cascade. This permits of "steering" the main lobe of radiation and control of the interference pattern in the XZ plane." To be continued.

621.396.677.029.6 **1457**

High-Gain Microwave Antennas.—W. G. Tuller. (*QST*, March 1946, Vol. 30, No. 3, pp. 34–40, 122.) A survey of antenna arrays developed for radar during the war, and of their possible uses in amateur communication. Types discussed include a dipole array with a plane reflector, a parabolic dish fed by a dipole, and a cut dish fed by a waveguide and radiating horn. Types of feeder include the solid-dielectric coaxial line, the rectangular waveguide, and the stub-supported coaxial line. Design and performance data for representative arrays for 200 Mc/s and 3 000 Mc/s are given. Brief mention is made of many possible variations.

CIRCUITS

621.317.733 **1458**

Note on the Helmholtz Make-and-Break Theorem and an Application to the Wheatstone Net.—Freeman. (*See* 1593.)

621.318.572 **1459**

Pulse-Integrating Circuit.—W. N. Tuttle. (*Radio, N.Y.*, Jan. 1946, Vol. 30, No. 1, p. 42.) The pulses to be counted are passed through a valve with zero plate voltage to a capacitor with a suitable leak resistance. The d.c. potential difference created across the capacitor is proportional to the rate of arrival of the pulses, and is measured with a triode voltmeter. Summary of U.S. Patent 2 374 248.

621.318.572 **1460**

Geiger-Muller Counter Technique for High Counting Rates.—C. O. Muehlhause & H. Friedman. (*Phys. Rev.*, 1st/15th Jan. 1946, Vol. 69, Nos. 1/2, p. 46.) A G-M counter coupled to a 4-Mc/s-wide video amplifier followed by a scaling circuit and a triggered-sweep oscilloscope (see 1859 of 1942—Stever) enabled counting rates up to 10^5 sec^{-1} to be obtained. Summary of Amer. Phys. Soc. paper.

621.318.572 : 621.317.361 **1461**

Decade Counting Circuits.—Regener. (*See* 1581.)

621.392 + 621.396 [.622 + .64 **1462**

I.R.E. Winter Technical Meeting January 1946.—(*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 80..93.) Abstracts are given of the following papers read at the meeting. Capacitance-Coupled Wide-Band Intermediate-Frequency Amplifiers.—M. J. Larsen & L. L. Merrill. Directional Couplers.—W. W. Mumford. From Wiring to Plumbing.—E. M. Purcell. Equivalent Circuits for Wave-Guide Structures.—J. Schwinger. Discriminators for Frequency-Modulation Receivers.—S. W. Seeley. Stagger-Tuned Wide-Band Amplifiers.—H. Wallman. For other abstracts see *Electronics*, March 1946, Vol. 19, No. 3, pp. 92..108, and *Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 62..74. For titles of other papers read, see other sections.

621.392.5 : 621.396.619.018.41 **1463**

The Transmission of a Frequency-Modulated Wave Through a Network.—W. J. Frantz. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, March 1946, Vol. 34, No. 3, pp. 114–125.) The paper was prompted by the increasing use of frequency-modulated signal generators in conjunction with a cathode-ray-tube display for investigating the bandwidth, etc., of amplifiers. The possible errors arising in such testing procedure are investigated in detail, but the results are of general application. "A practical [and simple] method for calculating the effect of a four-terminal network upon a frequency-modulated wave being transmitted through it is developed and demonstrated. . . [It is] equally accurate and practical for large and small values of modulation index and for any physical network." The amplitude and phase of the output voltage is expressed as a function of time or of instantaneous input frequency. A simple expression is derived giving the necessary correction to the output-voltage/frequency characteristic determined under steady-state conditions. Practical worked examples are included.

621.392.52 **1464**

Analysis of a Resistance-Capacitance Parallel-T Network and Applications.—A. E. Hastings. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, March 1946, Vol. 34, No. 3, pp. 126–129.) ". . . to find the conditions for a null in output and the transfer characteristic. Its use in the return circuit of a feedback amplifier is considered, and the bandwidth of the resulting tuned amplifier is found. The requirements for stability of the amplifier and for its use as an oscillator are discussed." The discussion deals with three arrangements, and is mainly concerned with networks in which the resistive and capacitive elements respectively, comprising the horizontal arms of the two T's, are equal. For such a network interposed in the feedback link of an amplifier, the maximum available "effective *Q*" of the amplifier is a quarter of the voltage gain of the unit before feedback is applied.

621.392.52 **1465**

Bridged-T Null Networks.—Z. Bryl. (*Proc. Instn Radio Engrs, Aust.*, Nov. 1945, Vol. 6, No. 5, pp. 8–9.) Mathematical derivation of conditions necessary for zero transmission.

621.392.52 **1466**

Bridged-T Circuit.—R. B. Essex. (*Radio Craft*, Feb. 1946, Vol. 17, No. 5, p. 316.) The use in amplifier design is described. The circuit can be arranged either to suppress one particular frequency or to suppress all but one frequency. Numerical data for computing the network parameters are given.

621.392.52 : 512.831 **1467**

Applications of Matrix Algebra to Filter Theory.—P. I. Richards. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, March 1946, Vol. 34, No. 3, pp. 145–150.) "After a brief introduction to matrix notation, methods are presented for the derivation of design equations for filter sections with special attention to symmetrical types. Finally, insertion and mismatch loss formulas, obtainable directly from the matrices, are given." The matrix notation for each of the circuit components normally encountered in filter design is given. It is shown that the matrix for the whole filter is formed by multiplying, in the order of connexion, the individual matrices of the circuit components. From a knowledge of the elements in the complete filter matrix it is shown how to derive the properties of the filter: conversely, the method may be used to design a filter having specified properties.

621.394/.397].645 **1468**

On Maximum Gain—Band Width Product in Amplifiers.—W. W. Hansen. (*J. appl. Phys.*, Feb. 1946, Vol. 17, No. 2, p. 109.) Correction to 3810 of 1945 (Hansen).

621.394/.397].645 **1469**

Radio Design Worksheet: No. 44—The Cathode Follower Circuit.—(*Radio, N.Y.*, Jan. 1946, Vol. 30, No. 1, p. 44.)

621.394/.397].645 **1470**

Network Design Using Electrolytic Tanks.—R. W. Kenyon. (*Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 58–60.) "Every amplifier has specific complex frequencies at which the gain is infinity [poles], and other complex frequencies at which the gain is zero [zeros]." In the electrolytic tank the locations of the poles and zeros (which uniquely determine the shape of the frequency/gain curve) are represented by electrodes suitably placed and energized. A probe electrode connected to a valve voltmeter enables the gain function to be determined. A short account of the design, and an outline of typical applications of the tank in amplifier design are given.

621.394/.397].645 : 621.396.822 **1471**

Noise Factor of Valve Amplifiers.—N. R. Campbell, V. J. Francis & E. G. James. (*Wireless Engr*, April 1946, Vol. 23, No. 271, pp. 116–121.) Conclusion of 1191 of May. A definition of noise factor is given, and on the assumption that all the quantities concerned are either zero or a constant value, formulae are derived and applied to transformer-coupled stages and to a common-cathode pentode stage. The effect on the noise factor of the addition of a pre-amplifier before the first stage of an amplifier is shown to be the same as if the amplifier produced no noise but the load conductance of the pre-amplifier were increased.

621.394/.397].645.34 **1472**

Selective Amplifiers.—B. M. Hadfield. (*Electronic Industr.*, March 1946, Vol. 5, No. 3, p. 104.) ". . . a frequency-selective amplifier or oscillator of the feedback type . . . which permits frequency control by adjustment of one potentiometer in the feedback circuit." Summary of U.S. Patent 2 386 892.

621.395.645 **1473**

Telephone Amplifier.—H. K. van Jepmond. (*Electronics*, March 1946, Vol. 19, No. 3, p. 139.) Simple two-way amplifier for use on privately serviced telephone lines.

621.395/.397].645 : 621.396.619.018.41 **1474**

Carrier-Frequency Amplifiers: Transient Conditions with Frequency Modulation.—C. C. Eaglesfield. (*Wireless Engr*, April 1946, Vol. 23, No. 271, pp. 96–102.) The "transient modulation ratio" is defined as the ratio of the modulation at the output to that at the input, and the general equations for it are obtained assuming an instantaneous change of amplitude or frequency at the input. The equations are simplified by considering small modulation values only, and by making the carrier frequency coincide with the central frequency of the amplifier. For "staggered" circuits a simple relation between modulation ratios for a.m. and f.m. is obtained, and graphical results for representative amplifiers are shown. With modification, the results can be used for coupled circuits. See also 1196 of May and 68 of January (Eaglesfield).

621.395.645 : 621.395.44 **1475**

A New Linear Amplifier Circuit.—S. T. Fisher. (*QST*, Feb. 1946, Vol. 30, No. 2, pp. 21–26.) A less detailed account of the system described in 877 of April.

621.395.645 : 621.395.8 **1476**

Hum Elimination.—J. C. Hoadley. (*Radio-Craft*, Feb. 1946, Vol. 17, No. 5, pp. 313..356.) A review of possible sources of mains-voltage hum in amplifiers together with design hints for its elimination. Some of the less obvious causes of hum, such as multiple grounding to chassis and emission from the exposed parts of cathode heater elements, are dealt with.

621.395.645 : 621.395.8 **1477**

The Effect of Negative Voltage Feedback on Power-Supply Hum in Audio-Frequency Amplifiers.—G. Builder. (*Proc. Inst. Radio Engrs, N.Y.*, Part II, March 1946, Vol. 34, No. 3, pp. 140–144.) Analysis leading to the conclusions (*a*) Under conditions of simple negative feedback, the signal/hum ratio at constant signal output is improved by the gain-reduction factor $(1-\beta M)$. This factor is, in general, complex and frequency-dependent. (*b*) "Failure to achieve the improvement in signal/hum ratio thus predicted may be due to the feedback voltage's including voltage other than the fraction β of the output voltage required for simple negative feedback . . ." (*c*) "In general, hum balancing within the amplifier is independent of the feedback only when the conditions for simple negative feedback are satisfied." (*d*) With an amplifier employing feedback, it is not generally valid to calculate the output hum voltage by simple potential division between the load impedance and the effective anode impedance of the valve if the latter is taken to be $R_a/(1-\mu\beta)$. A particular case is considered, however, when this procedure is permissible. The case of an amplifier having transformer coupling to the load is discussed in detail, with extensions to cover other types of output arrangements.

621.395.645.3 : 621.385.2 **1478**

A Voltage Amplifier Using a Pre-Saturation Diode as Load.—A. M. I. A. W. Durnford. (*Canad. J. Res.*, Sept. 1944, Vol. 22, Sec. A, No. 5, pp. 67–76.) "Pre-saturation characteristics for various types of diodes indicate that for constant plate voltage, the product of plate current and plate resistance is constant for each diode. ($i_d r_{pd} = K$). For different diodes, the value of K varies from 200 to 700 V for a plate voltage of 125 V. Tubes with thoriated tungsten cathodes have the highest K values with K proportional to plate voltage which renders the logarithmic characteristics linear and parallel. The pre-saturation diode when used as a load provides a high resistance that does not require an exceedingly large supply voltage. If the quiescent plate voltage, E_{bo}, is kept constant, the effective load lines converge at a common point, the voltage of which represents a virtual supply voltage equal to $E_{bo} + K$. Voltage gain and maximum distortionless output are both greater than when a fixed resistance is used as load. Variation of the filament current of the diode, or of a self-bias resistor, provides a distortionless gain control. The gain is almost constant for frequencies less than 300 c.p.s. but for high frequencies drops more rapidly."

621.395.645[.33 + .35 **1479**

A Constant Time Interval Reference Potential Indicator for Use with R-C Coupled Amplifiers.—E. W. Kammer. (*Rev. sci. Instrum.*, March 1946, Vol. 17, No. 3, pp. 102–106.) A device used for the observation of low-frequency signals such as those produced in the recording of dynamic strain in structures. The input signal is chopped rapidly to form a carrier which can then be amplified. The electronic switch, consisting of two cathode followers and a differential amplifier, is operated by a pulse with recurrence frequency 1 000 per sec and 10^{-4} sec duration.

621.395.645.34 + 621.396.63 **1480**

[Frequency-] **Selective Control Circuit.**—E. S. Purington. (*Radio, N.Y.*, Jan. 1946, Vol. 30, No. 1, p. 59.) A double-triode amplifier circuit with selective feedback designed to operate a relay when excited with a predetermined frequency of about 10 c/s. Summary of U.S. Patent 2 382 097.

621.396/.397].645.31 **1481**

Some Considerations in the Design of Wide-Band Radio-Frequency Amplifiers.—J. E. Cope. (*J. Instn elect. Engrs*, Part I, Feb. 1946, Vol. 93, No. 62, p. 109.) Summary of 576 of March.

621.396.611 : 621.396.615.14.029.63 **1482**

Tunable Microwave Cavity Resonators.—J. J. Guarrera. (*Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 80..122.) Design of coaxial resonators and associated components for use with disk-sealed triode oscillators, with particular reference to tuning, feedback, and shorting-plug problems. The design and testing of assemblies for operation under Service conditions are briefly discussed. See also 1483.

621.396.611 : 621.396.615.14.029.63 **1483**

Cavity Oscillator Circuits.—A. M. Gurewitsch. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 135–137.) Outline of the design of re-entrant type cavity circuits for use with disk-sealed triodes (lighthouse tubes) in the decimetre band of wavelengths. A number of different mechanical arrangements are described and illustrated: typical dimensions are given for wavelengths in the 9–30 cm region together with an indication of operating voltages and currents under c.w. and pulsed conditions.

621.396.611.2.029.62/.63 **1484**

Tuned Circuit Design for U.H.F.—M. Apstein & M. Joffe. (*QST*, Feb. 1946, Vol. 30, No. 2, pp. 13–16, 106.) Photographs and drawings of an LC circuit with three interchangeable coils, for use with an acorn triode to oscillate over the range 140–450 Mc/s.

621.396.611.3 : 621.396.615.1 **1485**

Bimodal Oscillator.—S. Lubkin. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 242..248.) Various examples are quoted of circuits having two closely-spaced natural frequencies. The advantages to be expected from using such circuit elements in the construction of beat-frequency oscillators, together with methods for varying the frequency separation, are discussed. Possible circuits are described; one suggested arrangement is to pulse-excite the double-peaked circuit, using the output beat frequency to synchronize the exciter.

621.396.615.17 **1486**

Rectangular-Pulse Generator.—R. K. McCombs & F. C. Walz. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 222..228.) Long summary of 4136 of 1945.

621.396.615.17 : 578.088.7 **1487**

Nerve Stimulator.—Weiss. (*See* 1609.)

621.396.615.17 : 621.397.335 **1488**

Synchronizing Generators for Electronic Television.—A. R. Applegarth. (*Proc. Inst. Radio Engrs*, Part II, March 1946, Vol. 34, No. 3, pp. 128–139.) "The system of electronic circuits employed to generate the complex wave forms required as a base for television picture transmission is described. It comprises four principal sections which are: (1) source of accurately timed pulses; (2) frequency-divider chain; (3) components-generating circuits; and (4) signal-synthesis circuits. The various means for accomplishing these functions are briefly discussed, and illustrated by circuits which have been used successfully for such purposes in practical applications."

621.396.619 **1489**

Carrier Wave Modulation.—W. R. Bennett. (*Radio, N.Y.*, Jan. 1946, Vol. 30, No. 1, p. 42.) A circuit for reducing second-harmonic distortion in a ring-type balanced modulator when the signal frequency is too close to the sideband frequency to be conveniently separated by filters. Summary of U.S. Patent 2 377 858.

621.396.619 : 621.396.933.2 **1490**

Modulation Circuit.—Alford & Patterson. (*See* 1548.)

621.396.619.018.41 : 621.396.622 **1491**

Frequency Discriminator.—G. G. Bruck. (*J. appl. Phys.*, March 1946, Vol. 17, No. 3, p. 213.) Letter giving preliminary notice, with circuit diagram, of a discriminator that is insensitive to amplitude. "The circuit . . . is essentially an oscillator which falls into step with an incoming signal. The differential plate-current of the two halves of the [double triode] tube is the discriminator output."

621.396.621.53 **1492**

Calculation of the Output from Non-Linear Mixers.—H. Stockman. (*J. appl. Phys.*, Feb. 1946, Vol. 17, No. 2, pp. 110–120.) A detailed critical survey of existing methods of determining the mixer performance of non-linear conductors from an assumed knowledge of the current/voltage characteristic. The methods are compared for consistency by application to a typical diode characteristic, and the discrepancies range from − 25% to + 35%. It is concluded that there is no " best " method and that " all methods require simplifying assumptions that frequently lead the converter designer to consider practical measurements or special methods such as the frequency-conversion diagram technique ". The latter is a compromise between direct measurement and complete computation, due to Chaffee, and is described in detail in a number of papers by H. Stockman (*e.g.* 778 of 1945 and 408 of February).

621.396.645 + 621.396.61 **1493**

Analysis of Parasitic Oscillations in Radio Transmitters.—Jackson. (*See* 1714.)

621.396.645 **1494**

A 4.3-Mc. F.M./A.M. I.F. and Audio Amplifier.—J. W. Brannin. (*QST*, March 1946, Vol. 30, No. 3, pp. 51–54.) Circuit and constructional details. A beat oscillator is included for c.w. reception.

621.396.645.029.62 **1495**

A V.H.F. Amplifier Using the 829.—G. G. (*QST*, March 1946, Vol. 30, No. 3, pp. 55–56.) Constructional details. 50 W output at 144 Mc/s.

621.396.645.34 **1496**

Selective Amplifier or Oscillator.—B. M. Hadfield. (*Radio, N.Y.*, Jan. 1946, Vol. 30, No. 1, pp. 42–43.) A feedback amplifier with a narrow pass band that can be varied over several octaves by a single potential divider. It may also be used as an oscillator over the same frequency range. Summary of U.S. Patent 2 386 892.

621.396.662.32 **1497**

The Ideal Low-Pass Filter in the form of a Dispersionless Lag Line.—M. J. E. Golay. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, March 1946, Vol. 34, No. 3, pp. 138–144.) " Some theoretical and practical aspects of the design . . . are considered. It is shown, in particular, that an artificial line made up of series inductances and shunt capacitances, with 18 per cent aiding mutual inductance between adjacent coils and 8 per cent shunt capacitance between alternate tie points, forms, for many purposes, a sufficiently good approximation of a dispersionless lag line. The mathematical study of the function $f(n) = \int_0^\pi (1 - \cos\phi/\phi^2) \cos n\phi \, d\phi$, which is of pertinent interest in lag-line theory, is given in an appendix." The modification of the values of line components to take account of resistive losses, and the effective characteristic impedance of the line are briefly examined.

621.396.662.34 **1498**

H.F. Band-Pass Filters: Part III.—H. P. Williams. (*Electronic Engng*, March 1946, Vol. 18, No. 217, pp. 89–93.) Examination of the response of coupled dissimilar circuits with unequal damping and staggering. The position and separation of the peaks, the gain on tune and the response well off tune are derived, and the results applied to interstage and aerial coupling circuits. An approximate treatment of the signal/thermal-noise ratio is given. For previous parts see 895/896 of April.

621.396.9 **1499**

Loran Indicator Circuit Operation.—Davidson. (*See* 1529.)

621.397.335 **1500**

Synchronizing and Separation Circuits: Part 12.—Noll. (*See* 1710.)

621.397.645 **1501**

Compensating Amplifier.—Gillespie. (*See* 1712.)

621.392.4 : 621.3.015.33 **1502**

Pulsed Linear Networks. [Book Review]—E. Frank. McGraw-Hill Book Co., New York, 267 pp., $3.00. (*Proc. Inst. Radio Engrs, N.Y.*, Part II, March 1946, Vol. 34, No. 3, pp. 159–160.) The networks examined are limited to simple types, but the treatment (by the classical method only) is clear and thorough.

GENERAL PHYSICS

532.517.4 **1503**

A Contribution to the Statistical Theory of Turbulence.—V. G. Nevzgljadov. (*C. R. Acad. Sci. U.R.S.S.*, 1945, Vol. 47, No. 7, pp. 466–468. In English.)

535.215 : 621.383 **1504**

Investigation of the Surface Photoelectric Effect of Metallic Films under the Influence of Strong Electrostatic Fields.—V. P. Jacobsmeyer. (*Phys. Rev.*, 1st/15th Jan. 1946, Vol. 69, Nos. 1/2, p. 50.) Photoelectric current from Bi films and a " liquid bright Pt " surface measured in fields up to 1.4×10^5 V/cm give a " Schottky line " which is consistent with the theoretical predictions of Guth & Mullin (1909 and 2766 of 1941). Summary of an Amer. Phys. Soc. paper.

535.3 **1505**

Transmission of Light by Water Drops 1 to 5 μ in Diameter.—R. Ruedy. (*Canad. J. Res.*, May/July 1944, Vol. 22, Sec. A, Nos. 3/4, pp. 53–66.) The size of growing drops of water formed as water vapour condenses can be determined by application of Mie's theory. As the drop size increases, the intensity of the transmitted light passes through a series of maximum and minimum values. This results in coloured light, and from observation of the cycles in changes of colour, the radius of the growing drops can be determined.

535.43 **1506**

Scattering of Light by Small Drops of Water.—R. Ruedy. (*Canad. J. Res.*, Dec. 1943, Vol. 21, Sec. A, No. 12, pp. 99–109.) Scattering of light of wavelength λ obeys Rayleigh's law for drop diameters up to $\lambda/4$. For diameters between $\lambda/4$ and λ, back radiation decreases almost to zero, and forward radiation obeys approximately a sixth power law. At the same time the colour of the scattered light changes gradually from blue, through the spectrum, to red.

536.2 **1507**

A Cylinder Cooling Problem.—S. A. Schaaf. (*Quart. appl. Math.*, Jan. 1946, Vol. 3, No. 4, pp. 356–360.) The problem of an infinitely long circular cylinder at an initial temperature above zero which is instantaneously immersed in an infinite medium initially at zero is solved by means of a Laplace transformation, leading to a solution in terms of Bessel functions.

536.2 : 621.315.2.017.7 **1508**

On a Modification of Forchheimer's Problem.—I. A. Charny. (*C. R. Acad. Sci. U.R.S.S.*, 1945, Vol. 48, No. 1, pp. 27–30. In English.) A mathematical paper on the determination of the heat losses from a length of tube buried in the ground, when the coefficient of heat transfer from the surface of the ground to the air has a finite value.

537.122 : 538.3 **1509**

Some Criticisms of the Theory of Point Electrons.—T. Lewis. (*Phil. Mag.*, Aug. 1945, Vol. 36, No. 259, pp. 533–541.) Dirac's analyses of the behaviour of point electrons (1822 of 1942 and previous work) contain a serious mathematical error, leading to false conclusions. Some of his results are invalid in so far as they are supposed to contain a term corresponding to radiation damping.

537.525 **1510**

On the Theory of the Varying Electric Discharge in Gases.—V. L. Granovsky. (*C. R. Acad. Sci. U.R.S.S.*, 1940, Vol. 26, No. 8, pp. 876–880. In English.) Varying discharge phenomena may be classified into (a) those associated with the electrical inertia of the discharge, (b) those associated with the thermal inertia of the gas and the electrode system. The paper deals with (a), with the following limitations :—1. The plasma is the main part of the discharge. 2. Displacement current small compared with conduction current. 3. Pressure not too low. 4. Plasma quasi-neutral (*cf.* Schottky's theory of ambipolar diffusion). 5. Maxwellian electron velocity distribution. 6. Energy of the electron gas derived from the electric field and lost by collision with gas molecules. 7. The normal atoms are directly ionized. 8. Tube connected to a source of e.m.f. through a resistance. Formulae are given for the balance of ions, the equation of ionization, the balance of energy in the electron gas, the equation of mobility and the current. See 1224 of May (Granovsky) for a sequel to this paper.

537.525 : 621.3.029.64 **1511**

Initiation of High Frequency Gas Discharges.—Holstein. (*See* 1726.)

537.525.82 **1512**

Computation of the Positive Column Characteristics.—B. Klarfeld. (*C.R. Acad. Sci. U.R.S.S.*, 1940, Vol. 26, No. 9, pp. 873–875. In English.) Deals with the calculation of the discharge characteristics from the atomic properties of the gas. The theory, now freed from previous simplifying assumptions which limited the pressure range, has been extended to cover the whole range within which the low-pressure plasma theory remains valid, and has been confirmed by experiments with mercury vapour. (See V. Granovsky, *Bull. Acad. Sci. U.R.S.S.*, Sér. phys., 1938, No. 4, p. 419.)

537.581 **1513**

An Explanation of Anomalous Thermionic Emission Current Constants.—N.-T. Sun & W. Band. (*Proc. Camb. phil. Soc.*, Feb. 1946, Vol. 42, Part 1, pp. 72–77.) Anomalously large or small values of the constant A in the thermionic current formula for metals, ($I = AT^2e^{-\chi/kT}$), are explained by taking into account the sharing of free electrons by two competing overlapping energy bands. Cases where one overlapping energy band is nearly full and where both overlapping bands are nearly empty are considered, and are used to explain the observed values of A for nickel and hafnium.

538.1 **1514**

Resonance Absorption by Nuclear Magnetic Moments in a Solid.—E. M. Purcell, H. C. Torrey & R. V. Pound. (*Phys. Rev.*, 1st/15th Jan. 1946, Vol. 69, Nos. 1/2, pp. 37–38.) The absorption of r.f. energy by a solid material in a strong magnetic field due to changes of orientation of nuclear spin has been observed. The experimental method of determining the proton magnetic moment (using the transition relation $h\nu = 2\mu H$) is described. A resonant cavity (frequency 29.8 Mc/s) filled with paraffin wax was placed in a magnetic field and the r.f. power transmitted through the cavity balanced by a direct signal in antiphase. The magnetic field was varied until the very sharp resonance absorption (about 10 oersteds wide) was observed at 7 100 oersteds, giving 2.75 nuclear magnetons for the proton moment. The relaxation time to establish thermal equilibrium between the spins and the lattice was apparently less than a minute.

538.3 **1515**

Initial Boundary Problems of Electrodynamics.—J. N. Feld. (*C.R.Acad.Sci.U.R.S.S.*, 1945, Vol. 48, No. 3, pp. 172–174. In English.) A formal solution of the electromagnetic field within a space v bounded by a closed surface s when the tangential components of the electric and/or magnetic vectors are given as arbitrary functions of time. Equations (6) and (7) give the electric and magnetic fields at the point of observation assuming zero conductivity within v and zero tangential field at the surface s.

538.3 **1516**

A Study of Stationary Electromagnetic Modes for Region Between Parallel Perfectly Conducting Planes and Application to Electron Accelerator.—E. S. Akeley. (*Phys. Rev.*, 1st/15th Jan. 1946, Vol. 69, Nos. 1/2, p. 50.) Theoretical evaluation of the TM modes with circular symmetry and their relation to the design of the surfaces and the energy dissipation in an electron accelerator. Summary of an Amer. Phys. Soc. paper.

538.3 **1517**

Reciprocal Electric Force.—F. W. Warburton. (*Phys. Rev.*, 1st/15th Jan. 1946, Vol. 69, Nos. 1/2, p. 40.) From the assumed potential energy of two charges e and e' with relative velocity u the reciprocal force between them is obtained in a form involving certain undetermined coefficients and the relative acceleration of the charges. When the radius vector, velocity and acceleration are parallel, the usual mass-energy relation is found. The formulae are applied to calculating the change of magnetization and torque of a rod by a longitudinal current. It is suggested that the treatment provides a unified electromagnetic theory which is more complete than the conventional theory with the necessary relativity corrections.

553.631 : 621.3.011.2 **1518**

Effect of Transverse Pressure on the Steady-State Electrical Conductivity of Rocksalt.—Hamtil. (*See* 1557.)

621.314.632 **1519**

A Method for Measuring Effective Contact E.M.F. between a Metal and a Semi-Conductor.—W. E. Stephens, B. Serin & W. E. Meyerhof. (*Phys. Rev.*, 1st/15th Jan. 1946, Vol. 69, Nos. 1/2, pp. 42–43.) Bethe's theory for the current in a rectifier formed by the potential barrier between a metal and a semiconductor gives $j = j_0 \exp\left(-\frac{e\phi}{kT}\right)$ $\left[\exp\left(\frac{eV}{kT}\right) - 1\right]$ where j_0 is the available current, ϕ the effective contact e.m.f., and V the applied voltage across the contact. If the resistance of the contact at zero applied voltage is R at temperature T, and $\log(R/T)$ is plotted against $1/T$, the effective contact e.m.f. ϕ can be deduced. [Reference is made to Fig. 1 which has been omitted.] ϕ is of importance in the operation of rectifiers and thermistors, and by correcting it for image force and the tunnel effect, the true difference of work function can be estimated.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.5 : 621.396.11 **1520**

Meteoric Impact Ionization Observed on Radar Oscilloscopes.—O. P. Ferrell. (*Phys. Rev.*, 1st/15th Jan. 1946, Vol. 69, Nos. 1/2, pp. 32–33.) Report on short-duration echoes observed on about 40 Mc/s and 100 Mc/s and attributed to ionic clouds formed by meteoric impact. On 105 Mc/s the echoes lasted for about ½–3 sec, and occurred at ranges of 30–125 km, with maximum rate of occurrence in the early morning (0100–0700) peaking at about 0400 hours.

523.72 **1521**

Radio Noise from the Sun.—Department of Scientific and Industrial Research. (*Electronic Engng*, March 1946, Vol. 18, No. 217, p. 98.) A brief account of the phenomenon described in 323 of February (Appleton).

551.515.43 : 621.396.9 **1522**

Spotting Hurricanes and Thunderstorms by Radar.—Winters. (*See* 1541.)

631.437 : 621.3.011.2 **1523**

The Use of Cumulative Resistance in Earth-Resistivity Surveys.—R. Ruedy. (*Canad. J. Res.*, July 1945, Vol. 23, Sec. A, No. 4, pp. 57–72.) When the soil consists of layers having different resistivities, an almost linear relation is obtained between the cumulative resistance and the electrode spacing until the distance between electrodes is equal to the thickness of the upper material. Earth-resistivity and cumulative-resistance curves are interpreted for some typical terrains.

551.5 (021) **1524**

Dynamic Meteorology. [Book Review] — J. Holmbe, G. E. Forsythe & W. Gustin. John Wiley & Sons, New York, $4.50, Chapman & Hall, London. (*Curr. Sci.*, Feb. 1946, Vol. 15, No. 2, p. 54.) " . . . an ideal and up-to-date text-book for the advanced student."

LOCATION AND AIDS TO NAVIGATION

621.383 **1525**

Sensory Aid for the Blind.—Cranberg. (*See* 1620.)

621.396.62 + 621.396.9 **1526**

Germany's UHF Tubes [Radar Camouflage].—Combined Intelligence Sub-Committee. (*See* 1648.)

621.396.82 : 621.396.67 **1527**

QRM—The Electronic Life Saver : Part II.—P. Robbiano. (*QST*, Feb. 1946, Vol. 30, No. 2, pp. 27–35.) Description of receiving equipment and of aerial systems used in radar countermeasures, including a cone aerial for 300–3 000 Mc/s, and a " fish hook " aerial for 500 Mc/s. For part I dealing with jamming transmitters, see 1060 of April.

621.396.9 **1528**

I.R.E. Winter Technical Meeting January 1946.—(*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 80 . . 92.) Abstracts are given of the following papers read at the meeting. Considerations of Frequency, Power, and Modulation for a Long-Range Radio Navigation System.—P. R. Adams. Broad-Band Antennas and Direction-Finding Systems for Very High Frequencies.—A. Alford, J. D. Kraus, A. Dorne & J. Christensen. Naval Airborne Radar.—L. V. Berkner. Airborne Radar Equipment for Aircraft Interception.—F. L. Holloway, R. P. Burrows & J. E. Keto. The Theory and Application of the Radar Beacon.—R. D. Hultgren & L. B. Hallman, Jr. Enemy Radio and Radar Equipment.—E. L. Luke & J. C. Link (Title only). Application of Radar Techniques to Aircraft Fire-Control Systems.—E. A. Massa, I. Paganelli & F. A. Best, Jr. The Role of Electronics in Antiaircraft Gun-Fire Control.—F. B. MacLaren. Aircraft Automatic Position Plotter.—A. C. Omberg & W. L. Webb. Radar Model XAF.—R. M. Page. An Introduction to Hyperbolic Navigation.—J. A. Pierce. A Frequency-Modulated Altimeter for Meter and Light Indication and the Automatic Altitude Control of Aircraft.—R. C. Sanders, Jr., W. R. Mercer, J. Wolff & J. C. Smith (Title only). An Automatic Visual-Indication Radio Direction Finder.—A. Scandurra & S. Stiber. Ground Controlled Approach.—E. Storrs, W. Devitt & B. Green. Radar Aspects of Naval Fire Control.—D. P. Tucker. A Pulse Altimeter for High Accuracy at High Altitudes.—I. Wolff, W. D. Hershberger, G. W. Leck & R. R. Welsh. (Title only). For other abstracts see *Electronics*, March 1946, Vol. 19, No. 3, pp. 92 . . 108, and *Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 62 . . 74. For titles of other papers read, see other sections.

621.396.9 **1529**

Loran Indicator Circuit Operation.—D. Davidson. (*Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 84 . . 132.) Brief discussion of propagation factors in Loran, leading to the following requirements in the design of the receiver-indicator :—" (1) a *slow* time base . . . to examine the entire recurrence cycle (40 000 μs) ; (2) a *fast* . . . time base (say, 200 to 2 500 μs) to enable identification of pulse train components and to permit a coincidence measurement of master and slave pulses ; (3) a *delay* circuit . . . so that a coincidence measurement can be made [that] will result in a time difference reading equal to the delay ; (4) an *amplitude balance* scheme so that the two pulses . . . may be made identical in shape during measurement ; (5) an effective method for sweep calibration in order that the time difference can be read with the required precision and rapidity ; (6) a method of splitting the time base so that the pulse from one station may be brought under that of its mate for superposition ; (7) a method of identifying the recurrence rates of the station pairs in a positive manner ; (8) ample sensitivity in the receiver . . . ; (9) the receiver bandwidth should be wide enough to allow satisfactory discrimination of sky and ground wave components and yet narrow enough to keep adjacent channel interference at a minimum." The manner in which these requirements have been met in the DAS–1 equipment for shipboard use is discussed in detail. The design of the airborne model is briefly mentioned, together with other variants of the basic design, in existence or contemplated.

621.396.9 **1530**

Loran Transmitting Stations.—D.G.F. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 109–115.) A description of the circuits and operating functions of the transmitter, timer, and synchronizer. The transmitter, generating 40-μs pulses at 1.7–2.0 Mc/s at a peak power of 75–150 kW, consists of a self-excited tuned-grid, tuned-anode, push-pull oscillator, pulse modulated in the cathode circuit. The modulator is driven by two exciters, so that two pulse sequences at slightly different rates can be generated simultaneously when necessary. The timing unit consists of a 50-kc/s quartz-crystal oscillator-circuit and six divider-circuits. The timer repeats the pulses, at 25 or 33⅓ pulses per second, so precisely that the accumulated timing error does not exceed 1 μs over a period of several minutes. To synchronize the pulse sequence of the slave station with that of the master station, the remote and local signals are displayed on a cathode-ray indicator and the phase of the transmitted keying system is adjusted until the two signals are superimposed. The phase adjustment may be made manually, or automatically, by switching in the synchronizing unit which holds the two sequences in synchronism to an accuracy of 1 μs. This paper concludes a series. For previous parts see 605/606 of March.

621.396.9 **1531**

Loran—the Latest in Navigational Aids : Part III. Navigators' Equipment and Summary.—A. A. McKenzie. (*QST*, Feb. 1946, Vol. 30, No. 2, pp. 62 . . 124.) For previous parts see 926 of April.

621.396.9 **1532**

Loran — Radio Navigation Aid.—E. F. Brissie. (*Radio Craft*, Jan. 1946, Vol. 17, No. 4, pp. 236 . . 292.) A simple account of the system.

621.396.9 **1533**

Technical and Tactical Features of Radar.—J. H. DeWitt, Jr. (*J. Franklin Inst.*, Feb. 1946, Vol. 241, No. 2, pp. 97–123.) Military uses of ground radar include aircraft warning, gun laying, searchlight control, and ground-controlled interception. The basic principles are common to all these systems, the essential components being a timer, transmitter, antenna system, receiver, indicator, and power-supply unit. These components, and the operational use of a radar system, are discussed in general terms, and details are given of sets designed for various specific requirements. Precision must often be sacrificed in operational sets to obtain simplicity and to reduce weight.

621.396.9 **1534**

The [AN/] **MPG-1 Radar.**—H. A. Straus, L. J. Rueger, G. A. Wert, S. J. Reisman, M. Taylor, R. J. Davis & J. H. Taylor. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 140–147.) Details of the timing, p.p.i., B-indicator, and remote-B-indicator systems. Crystal-controlled sweeps, together with a special quadrant-type capacitive phase-shifter, enable a static range accuracy of ± 3 yd to be obtained. When calibrated by transmitted pulses, the accuracy is about ± 20 yd. For previous parts of this 3-part series, see 610 of March and 1250 of May.

621.396.9 **1535**

Radar on 50 Centimeters.—H. A. Zahl & J. W. Marchetti. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 98–103.) Details of the transmitter, receiver and display systems of the AN/TPS–3 equipment of which other parts weie described in 1249 of April. The transmitter comprises four triodes in parallel push-pull within a common envelope which also contains the grid and anode resonant lines. Tuning is effected externally by operation of a shorting bar on the filament lines. Power is taken by direct coupling to the anode line. The valve is modulated by 1.5-μs pulses from an artificial-line circuit discharged 200 times per second by a rotary spark gap : peak output power is 200 kW at 25–30% efficiency. The receiver comprises two stages of signal-frequency amplification, a crystal first detector, 6 i.f. stages (bandwidth 1.25 Mc/s), a diode second detector, and separate video stages for the A-scope and p.p.i. The noise figure of the receiver is about 10 db. Timebase lengths equivalent to 20, 60 and 120-mile ranges are provided for both display tubes. Separate timebase units, each triggered from the transmitted pulse, are provided, the timebase length in each case being controlled by variation of the characteristics of an asymmetric multivibrator. In the case of the p.p.i. the linear sweep voltage is distributed to the deflector coils by a rotary transformer (goniometer), the search coil of which rotates in synchronism with the aerial system, and carries the sweep currents. Range markers at 10-mile intervals are provided on the A-scope and p.p.i., use being made of a 9.3-kc/s oscillator keyed by the transmitted pulse.

621.396.9 **1536**

Lightweight Radar for Early Warning.—W. C. Hendricks. (*Communications*, Jan. 1946, Vol. 26, No. 1, p. 54.) Some details of the radar set AN/TPS–3. For a longer account see 1535 above.

621.396.9 **1537**

The SCR-584 Radar [Part III].—D.G.F. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 110–117.) " Details of the circuits for timing echoes to 0.01 microsecond, the deflection system for the plan position indicator, and the automatic antenna positioning gear are presented in this final installment." See 608/609 of March for earlier parts. A crystal oscillator at 81.95 kc/s is used to develop circular traces (on separate cathode-ray tubes) with circumferences equivalent to ranges of 32 000 yd and 2 000 yd respectively, and also a trigger at 1 707 c/s for actuating the transmitter. Signals appear as radial deflexions. A cursor on the 32 000-yd screen can be rotated to cover the selected echo. The 2 000-yd display is " gated " so that the trace is illuminated only for the equivalent of ± 250 yd on each side of the echo selected by the cursor on the long-range tube. A cursor on the 2 000-yd tube enables the range to be measured accurately. The p.p.i. circuits are arranged to provide magnetically deflected sweeps of either 70 000 or 35 000-yd range. Precautions are taken to ensure that the spot is at the centre of the tube at the beginning of each radial sweep. Intensity modulation is provided by the following signals (a) a signal to ensure that the tube is illuminated only during the outward sweep of the spot to the edge of the tube, (b) echoes from targets, (c) 10 000-yd marker pulses derived from a 16.4-kc/s oscillator shock-excited by the transmitted pulses, (d) an azimuth-marker pulse derived from the cursor setting on the long-range dial. Automatic target-following is provided.

621.396.9 **1538**

Elements of Radar : Parts II & III.—J. McQuay. (*Radio Craft*, Jan. & Feb. 1946, Vol. 17, Nos. 4 & 5, pp. 246..287 & 317..337.) Brief general descriptions of oscillators, aerials and waveguides, and of receivers and display systems. For part I see 930 of April.

621.396.9 **1539**

I.F.F.—(*Radio Craft*, Feb. 1946, Vol. 17, No. 5, p. 332.) A simple explanation of the principles of the system used during the war for distinguishing between enemy and friendly aircraft.

621.396.9 : 518.5 **1540**

Post Office Equipment for Radar.—P. A. Marchant & K. M. Heron. (*P.O. elect. Engrs' J.*, Jan. 1946, Vol. 38, Part 4, pp. 117–120.) The solution is given of the problems concerning the rapid interpretation of radar observations to a form suitable for teleprinter transmission to a control centre. The technique is an extension of multichannel selection circuitry.

621.396.9 : 551.515.43 **1541**

Spotting Hurricanes and Thunderstorms by Radar.—S. R. Winters. (*Radio News*, March 1946, Vol. 35, No. 3, pp. 45..104.) An illustrated account of the plotting of the path of a hurricane. See also 618 of March.

621.396.9 : 621.3.089.6 **1542**

Artificial Radar Target.—(*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 214, 216.) The radar pulse received on a dipole is heterodyned to a lower frequency, converted by a piezoelectric transducer to a pulse of mechanical vibration which is delayed by transmission along a glass rod, is reconverted by the transducer, and retransmitted at carrier frequency from the dipole to simulate a radar echo. The device is set up about 20 yards from the radar set, and, on account of the time delay, the echo appears as if from a distant target. It is used for test purposes. A German device.

621.396.9 : 623.26 **1543**

Land Mine Locators.—West. (*See* 1626.)

621.396.9 : 623.454.25 **1544**

Proximity Fuzes for Artillery.—Selvidge. (*See* 1627.)

621.396.931/.933].22.029.54/.56 **1545**

Twin Bearing DF Unit.—(*Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 79, 124.) Brief description of a compact, rotating, cross-loop, twin-channel d.f. with crossed-pointer indication—the Simon Radioguide, a variant of SCR-503-A. Frequency range 0.1 to 3.0 Mc/s in two units. Messages may be read while bearings are being taken.

621.396.933 **1546**

The Teleran Proposal.—P. J. Herbst, I. Wolff, D. Ewing & L. F. Jones. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 124–127.) Teleran (Television-Radar Air Navigation) is " a system of navigation and traffic control, utilizing existing television and radar techniques to present visual information directly to the pilot . . ." It comprises, in each aircraft, a television receiver, and a transponder beacon coupled to the altimeter. The transponder is interrogated by ground radar equipments located near each aerodrome, and coding introduced by the altimeters in the respective aircraft enables the position and track of the machines within given height limits to be displayed on p.p.i. tubes particular to the respective strata. These pictures are televised, together with superposed information (map of neighbourhood, wind velocity, visibility, etc.), to the aircraft. The pilot receives the information appropriate to his height ; he thus sees a map of the aerodrome neighbourhood, his own position and the position and course of other aircraft at roughly his own height. The system is designed also to assist the aircraft in landing. The properties of Teleran are compared with those of other navigation systems.

621.396.933.1/.2 **1547**

Radio and Radar Aids to Aerial Navigation.—R. L. Rod. (*Radio, N.Y.*, Vol. 30, No. 1, pp. 35..60.) An outline of systems, including the radio range, v.h.f. direction finder, Loran, the radar p.p.i., and Racon (radar beacon).

621.396.933.2 : 621.396.619 **1548**

Modulation Circuit.—A. Alford & G. K. Patterson. (*Radio, N.Y.*, Jan. 1946, Vol. 30, No. 1, pp. 41–42.) A circuit to produce an ordinary modulated carrier, and, simultaneously from different terminals, the sidebands without the carrier. Its use is proposed for a beacon system, in which the carrier is applied to one member of an aerial array, and sidebands only are applied to the other members, so that the modulation of the received signal is directional, but a constant carrier is available for a.v.c. Summary of U.S. Patent 2 383 456.

621.396.029.64 **1549**

Radiation Laboratory Technical Series. [Book Notice]—(*J. appl. Phys.*, Feb. 1946, Vol. 17, No. 2, pp. 105–106.) The results of 5 years' wartime work on radar (" 20 000 technical man-years ") are to be embodied in a series of 28 books on the physics and engineering of microwave radio. " For the first time the technical literature of a large subject is being created all at once on a uniform basis." The book will be prepared by staff of the Radiation Laboratory, with British collaboration, and will be published by the McGraw-Hill Book Company. See also *Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 254..262.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788+533.5 **1550**

Audio Aid for Vacuum-Leak Hunting.—V. Wouk. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 138–141.) For use with vacuum systems equipped with gauges which provide a variation of output voltage when there is a change in partial pressure of one or more of the gases in the system. The outside of the vacuum system is sprayed at the doubtful points with the appropriate gas; when a leak is discovered the change in d.c. output voltage (amplified if necessary) is applied to the grid of a thyratron relaxation oscillator, thus causing a frequency change. See also 1551 below.

531.788+533.5 **1551**

Frequency Modulated Oscillator for Leak Hunting.—W. M. Brubaker & V. Wouk. (*Rev. sci. Instrum.*, March 1946, Vol. 17, No. 3, pp. 97–98.) Leaks representing pressure rises of less than 4×10^{-8} mm have been detected. The circuit can also be used for general monitoring purposes. See also 1550 above.

531.788.6 **1552**

A Pirani Gauge for Use at Pressures up to 15 mm.—E. S. Rittner. (*Rev. sci. Instrum.*, March 1946, Vol. 17, No. 3, pp. 113–114.) Thin tungsten wire is supported inside pyrex capillary tubing, and used in a constant-resistance bridge circuit. Pressures up to 15 mm Hg can be recorded with an accuracy of $\pm$ 2.5% or better.

533.5 **1553**

Iron-Nickel-Cobalt Alloy for Sealing to Glass.—G. D. Redston & J. E. Stanworth. (*J. sci. Instrum.*, March 1946, Vol. 23, No. 3, pp. 53–57.) A report on some Kovar-type alloys for sealing to borosilicate glass. Expansion curves are shown, and the effect of composition is discussed. An alloy containing 29 ± 0.5% Ni, 17% Co, 0.3% Mn, 0.15% Si is proposed. Impurities affect the expansion, so the alloy is specified by comparing with a molybdenum rod. The differential expansion coefficient should be zero at 25° C, and the curve should pass through $(3 \pm 1) \times 10^{-4}$. The stresses in sandwiches of alloy and glass are discussed, using measured stress/temperature curves. It is shown that seals can be made with very low stresses at all temperatures.

533.5 : 621.791.3 **1554**

A Simple [laboratory] **Method of Sealing Gas- or Vacuum-Packed Tins.**—W. A. Bryce & H. Tessier. (*Canad. J. Res.*, Sept. 1945, Vol. 23, Sec. F, No. 5, pp. 304–305.) ". . . The heating element is a coil of resistance wire supported over a hole in a flat surface of the tin. When the heating circuit is closed, a small piece of solder previously hung in the upper end of the coil is melted and drops on the area about the hole and thereby produces an effective seal."

535.87 : 539.234 **1555**

High-Reflexion Films.—K. M. Greenland. (*J. sci. Instrum.*, March 1946, Vol. 23, No. 3, pp. 48–50.) An account of single- and multiple-layer films for neutral or coloured filters and beam splitters operating on the interference principle, and having a high optical efficiency. They are made by high-vacuum evaporation.

539.232 : 621.317.794 **1556**

Production and Properties of Nickel Bolometers.—F. G. Brockman. (*J. opt. Soc. Amer.*, Jan. 1946, Vol. 36, No. 1, pp. 32–35.) Filaments as thin as 0.1 micron are obtained by nickel-plating copper foil. Ribbons of foil are soldered to a platinum frame and the copper dissolved in potassium cyanide solution, leaving nickel ribbons with a temperature coefficient of resistance of 0.005 per deg, and a time constant of 5 millisec. An equation is derived relating resistance to the ambient temperature and current. Bismuth ribbons have been similarly prepared.

553.631 : 621.3.011.2 **1557**

Effect of Transverse Pressure on the Steady-State Electrical Conductivity of Rocksalt.—C. N. Hamtil. (*Phys. Rev.*, 1st/15th Jan. 1946, Vol. 69, Nos. 1/2, p. 50.) Transverse pressure of 33 kg/cm² produced 7% increase of d.c. conductivity (at 100 V) in the temperature range 300–317°C, attributed to the reduction of the polarization counter-e.m.f. Summary of an Amer. Phys. Soc. paper.

62 "1945" **1558**

Progress in Engineering Knowledge during 1945: Materials Engineering.—P. L. Alger, J. Stokley, C. F. Scott, H. B. Marvin, J. L. Tugman & K. W. Given. (*Gen. elect. Rev.*, Feb. 1946, Vol. 49, No. 2, pp. 9–19.) A review, with an extensive bibliography, covering many materials for mechanical and electrical use.

621.315.613.1 **1559**

Some Physical Properties of Mica.—P. Hidnert & G. Dickson. (*Bur. Stand. J. Res.*, Oct. 1945, Vol. 35, No. 4, pp. 309–353.) Samples of mica from different sources have widely different physical and electrical properties. The coefficients of thermal expansion of samples have been measured in a direction normal to the cleavage plane under a pressure of 30 lb/sq. inch and at temperatures up to 700° C. In some cases coefficients are only a few parts in 10^6 per deg C; in others they are 5% per deg over small temperature ranges. Large changes between initial and final dimensions may result from a heating and cooling cycle, and successive cycles may produce quite different effects. Power factors of raw samples, measured at 100 kc/s and 1 000 kc/s lie between 0.03% and 1%, but may be considerably different at the two frequencies. In general, a heating and cooling cycle causes a substantial increase in power factor. Heating also produces changes in opacity and colour, and X-ray diffraction photographs show that the overall physical changes are often associated with changes in fine structure.

621.315.616 **1560**

Synthetic Rubbers and Plastics: XI (Part I) Water and the High Polymer.—F. T. White. (*Distrib. Elect.*, Apr. 1946, Vol. 18, No. 162, pp. 107–110.) The water absorption characteristics of various organic materials are discussed in relation to molecular structure, with particular reference to the effect of the presence of the hydroxyl (–OH) group. The absence of this group in a polymer chain generally means low absorption, and *vice versa*. For part X, see 585 of March.

621.315.616.011.2 (213) **1561**

Some Wartime Problems with Electrical Insulating Materials.—S. A. Prentice. (*J. Instn Engrs Aust.*, Oct./Dec. 1945, Vol. 17, Nos. 10/12, pp. 197–204.) The chief conditions under which the performance of insulating materials is impaired are temperature extremes, humidity, and fungus growth. Curves are given for some phenolic resins showing the decay of insulation resistance with time under various conditions of temperature and humidity. The adverse effect of a period of storage at high humidity is illustrated. A cyclic humidity change also produces gradual deterioration. Ceramics are free from these defects, but surface conductivity is often serious. Some thermoplastic materials, *e.g.* polyvinyl chloride, are little affected by humidity, but most are subject to distortion at temperatures above about 70° C. Humidity effects are minimized by treatment with varnishes or waxes. Conditions of high humidity are conducive to fungus growth, which leads to surface leakage, directly, and also by assisting condensation. The required properties and applications of a number of base materials and protective coatings used in insulation are tabulated, and testing techniques described.

621.315.616.011.2 (213) **1562**

The Effect of High Humidity and Fungi on the Insulation Resistance of Plastics.—J. Leutritz, Jr. & D. B. Herrmann. (*ASTM Bull.*, Jan. 1946, No. 138, pp. 25–32.) A description of experiments determining the effect of prolonged exposure to fungi and 97% humidity on the insulation resistance of methyl methacrylate, glass-bonded mica, glass mat laminate phenolic, phenon fabric, phenol fibre, and wood-flour-filled phenol plastic. Lowering of resistance is produced, reaching a steady value in a period varying from a few hours to several weeks, according to the material. Fungus appears on all specimens during this period, but even in its presence, resistance recovery eventually occurs on reduction of humidity to 52%. Re-exposure to 97% humidity causes a rapid drop in insulation resistance, even in the case of methyl methacrylate, which, on initial exposure in the absence of fungus, shows only a very gradual decrease. In all cases, original insulation can be recovered by cleaning and drying, and deterioration under humid conditions can be retarded by surface varnishing. Water adsorption and absorption determine insulation degradation, the additional effect of fungus being negligible. A comprehensive bibliography is given.

621.357.5/.6] : 621.396.69 **1563**

Electroforming Microwave Components.—F. Hassell & F. Jenks. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 134–138.) Use is made of electroforming techniques to overcome the difficulty of obtaining accurately machined surfaces on the insides of waveguides and other microwave circuit components. Where the shape is such that the mandrel can be withdrawn from the finished component, use is made of differential expansion on heating to secure separation of plating and mandrel. Alternatively, a separating film of tin is first deposited on the mandrel and the film is melted before the mandrel is withdrawn. Where the shape prevents withdrawal, the mandrel is made of fusible alloy, wax, or of a material easily dissolved. The electroformed products are stress-free. The process is "noted for precision, if not for economy".

621.385.1.032.2 + 533.5 + 539.234 **1564**

Fine Wires in the Electron-Tube Industry.—G. A. Espersen. (*Proc. Inst. Radio Engrs, N.Y.*, Part II, March 1946, Vol. 34, No. 3, pp. 116–120.) ". . . Some fundamental basic properties which confront the wire manufacturer are briefly discussed. Design formulas, including a nomograph, are given for electron-tube filaments. The use of platings of gold, platinum, and zirconium on metals of the refractory group have assisted in the reduction of grid emission. A unique method of utilizing zirconium, both to accelerate the vacuum exhaust process and to serve as a continuous "getter", is described. A novel method of securing a uniform rate of evaporation of thin films of metals is discussed." The nomograph gives the length and diameter of tungsten wire needed to obtain a desired operating temperature under various conditions of voltage and current.

621.385.8.032.7 **1565**

Glass Problems in the Manufacture of Miniature Tubes.—H. J. Miller. (*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, p. 87.) Abstract of a paper read at the I.R.E. Winter Technical Meeting, January 1946.

679.5 **1566**

Frictional Heat.—C. A. Breskin. (*Sci. Amer.*, Jan. 1946, Vol. 174, No. 1, pp. 20–22.) A new process for welding, bonding, and moulding thermoplastics by generation of frictional heat. Bonding to non-plastics is also possible.

679.5 : 53.084 **1567**

Plastics and [plastic] **Cements : Applications to Scientific Instruments.**—J. C. Swallow. (*J. sci. Instrum.*, March 1946, Vol. 23, No. 3, pp. 44–48.) A discourse delivered at the Physical Society's thirtieth annual exhibition.

778 : [5 + 6 **1568**

Photography in Research and Development.—W. H. Banyard. (*Distrib. Elect.*, Apr. 1946, Vol. 18, No. 162, pp. 115–118.)

MATHEMATICS

512.831 : 621.392.52 **1569**

Applications of Matrix Algebra to Filter Theory.—Richards. (*See* 1467.)

517.93 + 518.12 **1570**

Solution of Linear and Slightly Nonlinear Differential Equations.—S. A. Schelkunoff. (*Quart. appl. Math.*, Jan. 1946, Vol. 3, No. 4, pp. 348–355.) A method based on the idea that solutions of linear differential equations may be regarded as distorted or "perturbed" sinusoidal or exponential functions, similar to the Rayleigh-Schrödinger treatment. Better results are obtained than by Picard's method which regards the solutions as perturbed straight lines. The method would be suitable for numerical solution of at least a certain class of differential equations, though it was originally developed to obtain convenient analytical approximations to a number of problems in wave theory.

517.947.4 **1571**

A Method of Solution of Field Problems by means of Overlapping Regions.—H. Poritsky & M. H. Blewett. (*Quart. appl. Math.*, Jan. 1946, Vol. 3, No. 4, pp. 336–347.) "In problems involving the determination of fields, it often happens that the region R for which the field is to be determined is difficult to handle directly, but can be broken up into several overlapping regions R_1, R_2, . . . for each of which the field can be determined by standard methods. We suppose that the breaking up is carried out in such a manner that every point of the region R falls into *at least one* of the regions R_1, R_2, . . ." The procedure is illustrated by consideration of the problem of propagation of a transverse electromagnetic wave round a corner formed by the junction at right angles of two regions bounded by infinite parallel plates.

517.948 **1572**

Some Integral Equations of Potential Theory.—H. Bateman. (*J. appl. Phys.*, Feb. 1946, Vol 17, No. 2, pp. 91–102.) Deals with integral equations of the type $f(x) = 1/\pi \int_{-\infty}^{\infty} \frac{yF(t)dt}{(x-t)^2 + y^2}$ where y is a "fixed positive quantity", $f(x)$ is an analytic function supposed to be determined from observation, and $F(t)$ is the function to be determined. Such integrals arise from inverse potential problems. The function $F(t)$ is required to be such that the integral exists and represents a potential $V(x, y)$ regular for $y>0$, which is the solution of the Dirichlet problem for the half-plane.

518.61 **1573**

Calculation of the Magnetic Field in Dynamo-Electric Machines by Southwell's Relaxation Method.—H. Motz & W. D. Worthy. (*J. Instn elect. Engrs*, Part I, Feb. 1946, Vol. 93, No. 62, pp. 108–109.) Summary of 658 of March.

519.2 **1574**

On a Problem Connected with Purely Discontinuous Random Processes.—V. M. Dubrovsky. (*C. R. Acad. Sci. U.R.S.S.*, 1945, Vol. 47, No. 7, pp. 459–461. In English.)

518.2 **1575**

Table of Arc Sin X. [Book Review]—Mathematical Tables Project. Columbia Univ. Press, New York, 1945, 124 pp., $3.50. (*Proc. Inst. Radio Engrs, N.Y.*, Part II, March 1946, Vol. 34, No. 3, p. 160.) Gives values in radians to 12 decimal places, with 0.000 1 intervals from 0 to 0.989 0 and 0.000 01 intervals from 0.989 00 to unity. Interpolation aids are included.

MEASUREMENTS AND TEST GEAR

621.317 **1576**

I.R.E. Winter Technical Meeting January 1946.—(*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 80..93.) Abstracts are given of the following papers read at the meeting. Test Equipment and Techniques for Airborne Radar Field Maintenance.—E. A. Blasi & G. C. Schutz. A Spectrum Analyzer for Microwave Pulsed Oscillators.—F. J. Gaffney. Electrical Characteristics of Quartz-Crystal Units and Their Measurement.—W. D. George, M. C. Selby & R. Scolnik. A Three-Beam Oscillograph for Recording at Frequencies up to 10,000 Megacycles.—G. M. Lee (see 1692). Microwave Power Measurement.—T. Moreno & O. C. Lundstrom. A New High-Speed Recording Potentiometer.—V. L. Parsegian. Electronic Frequency Stabilization of Microwave Oscillators.—R. V. Pound. Metallized-Glass Attenuators for Radio-Frequency Applications.—E. Weber. The New "Speedomax" Power-Level Recorder.—A. J. Williams, Jr. & W. R. Clark. For other abstracts see *Electronics*, March 1946, Vol. 19, No. 3, pp. 92..108, and *Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 62..74. For titles of other papers read, see other sections.

621.317.31.082.5 : 621.362 **1577**

Electric Precision Measurements by Means of Incandescent Lamp Used as Indicator of Current Equality in Two Circuits.—A. L. Fürstenberg. (*C. R. Acad. Sci. U.R.S.S.*, 1945, Vol. 48, No. 1, pp. 23–26. In English.) "In an incandescent lamp with a metal filament the appearance of a barely visible light emission is a very fine criterion for visual estimation of the heating current. A circumstance of interest for metrology is that under conditions of a vanishingly small light emission by the filament, slight increments in the current passing through the lamp have a considerable effect upon brightness." Experiment shows that in the neighbourhood of this threshold light emission, an increase of ± 0.5% in current results in ± 50% increase in brightness. The possible use of the method for determining the equality of the currents in circuits is considered, with a brief discussion of the errors involved in using it for comparing inductors and capacitors. Errors are limited to a few parts in ten thousand.

621.317.33 : 621.317.755 **1578**

Impedance Measurements with the Cathode-Ray Oscilloscope.—W. Vissers, Jr. (*Radio, N.Y.*, Jan. 1946, Vol. 30, No. 1, pp. 23..62.) A source of voltage of the required frequency is connected to the unknown impedance in series with a known impedance. The voltage across the unknown is applied to the X-deflexion plates of a cathode-ray oscilloscope, and the total voltage is applied to the Y-plates. Measurements of the resulting ellipse enable the magnitude and phase of the unknown impedance to be found.

621.317.334/.335 **1579**

Simple Capacitance and Inductance Measurements.—T. A. Gadwa. (*QST*, March 1946, Vol. 30, No. 3, pp. 71..136.) The frequency-variation method is used.

621.317.361 + 531.76 **1580**

WWV Schedules.—(*QST*, Feb. 1946, Vol. 30, No. 2, p. 41.) Details of the standard-frequency transmissions by the National Bureau of Standards (station WWV) at 2.5, 5, 10 and 15 Mc/s. The accuracy of the carrier and modulation frequencies and of the time signals is better than 1 part in 10^7.

621.317.361 : 621.318.572 **1581**

Decade Counting Circuits.—V. H. Regener. (*Phys. Rev.*, 1st/15th Jan. 1946, Vol. 69, Nos. 1/2, p. 46.) Ten miniature pentodes (6AK6) in a ring with 30 resistors and 10 capacitors, or ten twin-pentodes (12L8–GT) with 20 resistors and no capacitors form counters suitable for frequency measurement up to 100 kc/s with cathode-ray indication. Summary of Amer. Phys. Soc. paper.

621.317.361 + 621.396.611.21 **1582**

Duplex Crystals.—C. E. Lane. (*Bell Lab. Rec.*, Feb. 1946, Vol. 24, No. 2, pp. 59–62.) Two quartz crystal plates bonded together enable the lowest natural flexure frequency of a free bar to be excited and give resonance frequencies in the range 1 kc/s –10 kc/s. Methods of bonding and of inducing the required vibrations in the crystals are given, and their uses as oscillators and filters are described in general terms.

621.317.4 **1583**

A New Magnetomotive Force Gauge and Magnetic Field Indicator.—W. B. Ellwood. (*Rev. sci. Instrum.*, March 1946, Vol. 17, No. 3, pp. 109–111.) A compact instrument in which a magnetically operated reed switch is closed by the field being measured. Current through an external winding re-opens the switch, and the value of current required to do so is a measure of the field.

621.317.7 : 621.316.93 **1584**

An Electronic Bypass for Measuring Purposes.—L. A. Finzi. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 196..202.) A simple gas-tube circuit "for protection of . . . measuring instruments [against transient overloads] . . . where it is necessary to restore the normal instrument operation as soon as the current falls back within the limits of the instrument range."

621.317.714 + 621.317.725].089.6 **1585**

Production Testing of [d.c.] **Panel Meters.**—R. Ammon. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 170..178.) A 6N7 is used with variable grid bias to provide a smoothly variable rheostat; with a d.c. voltage source the rheostat is used to adjust the voltage across a standard 100-V voltmeter connected in parallel with the meter under test, which is itself arranged as a 100-V voltmeter by the use of a suitable series resistor.

621.317.714 **1586**

Multi-Range Milliammeter.—R. P. Turner. (*Radio News*, Feb. 1946, Vol. 35, No. 2, pp. 49..142.) Conversion of a commercial 0–1-mA meter to read 0–1 A d.c. in four decade ranges. The circuit is arranged so that standard-value resistors can be used.

621.317.725 **1587**

An Integrating Meter for Measurement of Fluctuating Voltages.—H. E. Haynes. (*J. Soc. Mot. Pict. Engrs*, Feb. 1946, Vol. 46, No. 2, pp. 128–133.) The meter integrates the voltage over a chosen interval, *e.g.* 0.5–5.0 sec, and indicates the average value that has existed. A combined voltage-amplifier and phase-inverter is followed by a full-wave rectifier and capacitor-charging circuit. Timing is accomplished by a resistance-capacitance circuit and a thyratron relay. The frequency response is flat from 50 c/s to 15 kc/s, and the instrument can withstand considerable overload.

621.317.725 : 621.314.632 **1588**

A.C. Voltage Measurements.—O. E. Carlson. (*Radio Craft*, Jan. 1946, Vol. 17, No. 4, pp. 250..275.) Summary of the properties of copper-oxide rectifiers in relation to their use in a.c. voltmeters.

621.317.725 : 621.385.2 **1589**

A Stable Diode Voltmeter.—Furzehill Laboratories, Ltd. (*Electronic Engng*, March 1946, Vol. 18, No. 217, p. 94.) A television-type diode feeding a triode d.c. amplifier in a bridge circuit with a microammeter for peak voltage measurements. The arrangement of the circuit to give a stable zero is described.

621.317.725 : 621.385.3 **1590**

High-Resistance D-C Voltmeter.—D. L. Waidelich. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 158–160.) The design of a reflex-type valve voltmeter that has maximum errors of 8% and 5% when measuring voltages of sources having internal resistances of 1 000 MΩ and 100 MΩ respectively. Over-voltage protection is provided, and no electrical zero adjustment is required. Voltage ranges 0–50, 100, 250 V.

621.317.725.029.3/.62] : 621.385.2 **1591**

R.F. Probe Design.—D. F. McAvoy. (*Radio News*, March 1946, Vol. 35, No. 3, pp. 35..135.) Constructional details of an r.f. diode probe used as an accessory for a d.c. valve voltmeter. A suitable circuit is described.

621.317.73.029.54/.58 **1592**

A Radio-Frequency Capacitance and Conductance Bridge.—R. F. Proctor & E. G. James. (*J. Instn elect. Engrs*, Part I, Feb. 1946, Vol. 93, No. 62, p. 103.) Summary of 676 of March.

621.317.733 **1593**

Note on the Helmholtz Make-and-Break Theorem and an Application to the Wheatstone Net.—G. F. Freeman. (*Phil. Mag.*, Aug. 1945, Vol. 36, No. 259, pp. 541–546.) In bridge networks it is often advantageous to consider a change in impedance as the independent variable, and to use the galvanometer as a deflexional instrument. Examples relating to the Wheatstone network are given.

621.317.761.029.63 **1594**

V.H.F. Heterodyne Frequency Meter.—A. A. Goldberg. (*Radio News*, March 1946, Vol. 35, No. 3, pp. 32..128.) A split-concentric-tuned oscillator, using an acorn valve, covers the range 280–430 Mc/s. Harmonic operation is possible up to 3 000 Mc/s, and the oscillator may be pulsed or square-wave modulated.

621.317.763.029.63/.64 **1595**

Types and Applications of Microwave Frequency Meters.—W. J. Jones. (*Radio, N.Y.*, Jan. 1946, Vol. 30, No. 1, pp. 29–34.) Three instruments commonly used are the coaxial-line, cylindrical-cavity, and transition types, the latter being a combination of the other two. The principles and methods of operation are described, and their accuracies briefly discussed.

621.317.763.029.63/.64 **1596**

A Resonant-Cavity Wavemeter.—J. McQuay. (*Radio News*, Feb. 1946, Vol. 35, No. 2, pp. 36..78.) Description of a waveguide fitted with an adjustable plunger and a neon indicator.

621.317.79 : [621.315.212.1.029.62/.63 **1597**

Measuring Coaxials at Ultra-High Frequencies.—C. C. Fleming. (*Bell Lab. Rec.*, Jan. 1946, Vol. 24, No. 1, pp. 2–5.) Methods of measuring cable attenuation by insertion loss are briefly described. Measurements at frequencies from 120 to 420 Mc/s can be made directly and can be extended to 3 000 Mc/s by a heterodyne system. Characteristic impedance is obtained at 100 Mc/s by a resonance method using a *Q* meter and standard calibrating resistors.

621.317.79 : 621.385 **1598**

A Method of Measuring Grid Primary Emission in Thermionic Valves.—A. H. Hooke. (*Electronic Engng*, March 1946, Vol. 18, No. 217, pp. 75–80.) In most valves the grid becomes contaminated and raised in temperature due to proximity to the cathode. The resulting primary emission is of importance, though not readily measurable because of the grid current due to gas and to secondary emission. The test circuit described supplies periodic voltages consecutively to the grid and anode, followed by the application of a high negative potential to the grid, during which time the grid primary emission is measured. The cycle is repeated at 60-millisecond intervals. The details of the circuit and its operation are given, and the interpretation of the meter readings discussed. Typical curves showing the grid emission as a function of grid dissipation, anode power and grid material are given. Two appendices give theoretical analyses of (i) the conversion of the measured average current and voltage to mean power for a linear and a 3/2-power law and (ii) the relation between the anode and grid dissipations for a given grid primary emission.

621.317.79 : 621.396.619.16 **1599**

Measuring Pulse Characteristics.—A. Easton. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 150–154.) Outline description of methods and apparatus required for measuring pulse spacing, pulse length, time of rise and time of decay. Long bibliography.

621.317.79 : 621.396.82 **1600**

Effectiveness of Conduit as R-F Shielding.—S. L. Shive. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 160..166.) Equipment for measuring the screening properties of conduits in the frequency range 0.1–150 Mc/s is described, with typical results. A screening box contains a transmitting coil at the end of a polystyrene rod, over which the conduit is slipped; a receiving loop mounted outside the conduit feeds a receiver external to the box. A standard-signal generator energizes the transmitting loop: the figure of merit for the conduit is the ratio of voltages (db) applied to the transmitter with and without the conduit, for a constant output from the receiving loop.

621.317.791 **1601**

Universal Test Instrument.—M. Silver. (*Radio News*, Feb. 1946, Vol. 35, No. 2, pp. 32..118.) A detailed description of a d.c./a.c. instrument with 51 ranges for voltage, current, resistance, and attenuation measurement. The voltmeter can be used at frequencies up to 100 Mc/s.

621.317.794 : 539.232 **1602**

Production and Properties of Nickel Bolometers.—Brockman. (*See* 1556.)

621.395.92 **1603**

The Testing of Deaf Aids.—Turney. (*See* 1441.)

621.396.615 : 621.317.79 **1604**

Wide-Range Electronic Sweeper.—A. D. Smith, Jr. (*Communications*, Jan. 1946, Vol. 26, No. 1, pp. 24..31.) Detailed description of an h.f. wobbulator for aligning television receivers. Range of mean frequency 500 kc/s–110 Mc/s, extensible to 220 Mc/s by harmonic operation, frequency sweep adjustable up to 10 Mc/s. Output independent of frequency to ± 10%. The signal is derived by a heterodyne process using a reactance tube to produce the sweep. 1-Mc/s and 10-Mc/s crystals are included to provide frequency markers.

621.396.615.12 **1605**

Signal Generator Covers All Bands.—B. White. (*Radio Craft*, Jan. 1946, Vol. 17, No. 4, pp. 243–244.) Constructional details of a mains-operated generator with continuous coverage from 65 kc/s–34 Mc/s, with plug-in coils. Internal modulator range 24–20 000 c/s.

621.396.615.12 : 621.317.79 **1606**

[TF.867] **Signal Generator.**—L. Hauser. (*J. sci. Instrum.*, March 1946, Vol. 23, No. 3, p. 63.) Letter correcting a statement on provisional operating data given in 1289 of May.

621.317.7 : 621.396 **1607**

Radio Test Instruments. [Book Review]—R. B. Turner. Ziff-Davis, New York, 1945, 228 pp., \$4.50. (*Electronic Industr.*, March 1946, Vol. 5, No. 3, p. 154.) "Of particular interest to amateur radio operators and experimenters, this book describes how to construct the great majority of instruments commonly used . . ."

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

538.3 **1608**

A Study of Stationary Electromagnetic Modes for Region Between Parallel Perfectly Conducting Planes and Application to Electron Accelerator.—Akeley. (*See* 1516.)

578.088.7 : 621.396.615.17 **1609**

Nerve Stimulator.—W. I. Weiss. (*Electronics*, Feb. 1946, Vol. 19, No. 2, p. 155.) "Thyratron-type relaxation oscillator with plate-supply keying [foot-operated, or panel switch] eliminates high initial pulse, provides 0.3 c/s–30 kc/s pulses for biological research and medical therapy." Circuit diagrams are given.

615.84 : 621.3.029.62 **1610**

Shortwave Diathermy.—J. M. Oxley. (*Radio Craft*, Jan. 1946, Vol. 17, No. 4, pp. 245..281.) Brief discussion of the biological basis of electrotherapeutic effects, with an outline of the principal methods used.

621.317.39.083.7 : 629.13 **1611**

Fuel Consumption Indicator.—D. W. Moore, Jr. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 152–153.) "Electronic servo transmits the position of an aircraft fuel-flow valve to a remote indicator. A mechanical integrator combines this information with impulses from a 100 c/s time standard to totalize the liquid flow. The device is applicable to industrial telemetering problems."

621.317.39.087.4 + 621.3.078 **1612**

Instruments for the Automatic Controlling and Recording of Chemical and other Processes.—Prinz. (*See* 1691.)

621.36/.39 **1613**

I.R.E. Winter Technical Meeting January 1946.—(*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 80..93.) Abstracts are given of the following papers read at the meeting. Electronics in Naval Warfare.—R. Bennett. Navy Radio and Electronics in World War II.—J. B. Dow. The Role of Electronics in Antiaircraft Gun-Fire Control.—F. B. MacLaren. A New System of Radio Telemetering.—D. W. Moore, Jr. & F. G. Willey. Duplex Operation of Independent High-Power Oscillators for Induction Heating.—W. C. Rudd. A Frequency-Modulation Altimeter for Meter and Light Indication and the Automatic Altitude Control of Aircraft.—R. C. Sanders, Jr., W. R. Mercer, I. Wolff & J. C. Smith (Title only). One-Millionth-of-a-Second Radiography and its Applications.—C. M. Slack & D. C. Dickson. For other abstracts see *Electronics*, March 1946, Vol. 19, No. 3, pp. 92..108, and *Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 62..74. For titles of other papers read, see other sections.

621.365.52 **1614**

Induction Heating of Hollow Metallic Cylinders.—A. Gemant. (*J. appl. Phys.*, March 1946, Vol. 17, No. 3, pp. 195–200.) "The rigorous expression for the heat input, valid for the whole frequency range, is developed . . . It is shown in an example how the equation is used for numerical computations. Existing approximate formulas for the low frequency and the high frequency ranges are checked by means of the rigorous equation ; the maximum deviation between the rigorous and approximate equations is about 10 per cent."

621.365.52 : 621.385.1 **1615**

Induction Heating in Radio Electron-Tube Manufacture.—E. E. Spitzer. (*Proc. Inst. Radio Engrs, N.Y.*, Part II, March 1946, Vol. 34, No. 3, pp. 110–115.) The following applications are considered :—degassing, getter-flashing, vacuum-firing, metal-to-glass sealing, brazing, and welding. Frequencies in the range 200–500 kc/s and powers of 2–15 kW are usually employed. The theory of this method of heating metallic elements is considered.

621.365.52 : 621.791.3 **1616**

R-F Soldering of Metal-to-Glass Seals.—R. A. Ammon. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 120–121.) 30-Mc/s heating generators, distributed throughout the plant and fed from a central power supply, are used in the production of sealed meters. Increased efficiency over ordinary techniques, such as the use of soldering irons, is obtained in soldering edge-metallized glass windows and glass-insulated feed-through terminals to the metal case of the instrument, in mounting polepieces on instrument magnets, and in soldering metallized glass jewel bearings in position. The generator circuit is given.

621.365.92 : 678.028 **1617**

High-Frequency Heating Developments.—(*Electronics*, March 1946, Vol. 19, No. 3, pp. 170..178.) Features of a 125-kW 13.6-Mc/s unit developed by Westinghouse for curing and drying a new sponge-rubber product. See also 698 of March.

621.365.92 : 678.028 **1618**

Electronic Rubber Preheater.—E. Mittelmann & G. P. Bosomworth. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 128–130.) A brief general description of the use of a 20-kW 27-Mc/s heating unit for preheating rubber parts, in readiness for curing.

621.38 : 62 **1619**

Economics of Electronics.—J. Markus. (*Sci. Amer.*, Dec. 1945, Vol. 173, No. 6, pp. 349–351.) A discussion on recent electronic developments, including references to ingenious but uneconomical devices.

621.383 **1620**

Sensory Aid for the Blind.—L. Cranberg. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 116–119.) A detailed account of the device noted in 1309 of May.

621.385.833 **1621**

Filmless Sample Mounting for the Electron Microscope [Airborne particles supported on thin glass fibres].—J. H. L. Watson. (*J. appl. Phys.*, Feb. 1946, Vol. 17, No. 2, pp. 121–127.)

621.386.1 : 620.179 **1622**

Production Control with 2,000,000-volt X-rays.—D. Goodman. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 146–149.) "Details of super-voltage installation using conventional X-ray tube construction and resonant transformer, and description of continuous industrial radiographic setup used during war for inspection of powder charges in large loaded shells and bombs."

621.386.1 : 621.396 **1623**

Notes on Radiography in the Wireless Industry.—R. M. Mitchell. (*Marconi Rev.*, Jan./March 1946, Vol. 9, No. 80, pp. 13–20.) A simple introduction to the subject is followed by a description of modern industrial X-ray plant. After a survey of the factors governing the making of satisfactory radiographs, practical applications, chiefly relating to physical examination of valves, are illustrated.

621.43 : 621.317.39 **1624**

Pressure-Time Curves in Electronic Observation of Engines.—W. F. Brown. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 168, 170.) Comprises a 100-kc/s bridge in which one of the arms includes a diaphragm-operated capacitor which is subjected to the pressure changes. An amplifier and detector system associated with the bridge enables either the full 100-kc/s output, the output with negative half-waves suppressed, or the envelope, together with timing marks, to be displayed on a synchronized oscillograph.

621.9 : 621.38 **1625**

Contouring Control for Machine Tools.—(*Electronics*, Feb. 1946, Vol. 19, No. 2, p. 178.) A stylus guides itself round a template at constant speed, or is drawn round a diagram like a pencil, and its motion controls the cutting operation through electronic mechanisms. "The new control . . . is capable of a variety of intricate cutting operations. . . ."

623.26 : 621.396.9 **1626**

Land Mine Locators.—S. S. West. (*Electronic Engng*, March 1946, Vol. 18, No. 217, pp. 69–74.) Models I, II and III are based on the Felici bridge in which equal and opposite mutual inductances give zero output. Two overlapping circular coils are adjusted to have zero coupling so that, when brought near a metallic object, an unbalance due to external coupling is produced. This unbalance is indicated by feeding one coil from an a.f. oscillator and amplifying the output from the other to headphones. A balancing circuit enables the initial stray reactive and resistive coupling to be annulled. A detailed description of the construction and of the circuit is given. A novel and improved locator (Model IV) gives discriminatory detection. The coils are connected respectively to the input and output of a 3-stage amplifier having negligible phase shift ; the coupling between the coils provided by a nearby object causes a.f. self-oscillation. By introducing a controllable phasing network, the detector can be made to have greatest sensitivity to a ferrous object, which produces a 90° phase shift.

623.454.25 : 621.396.9 **1627**

Proximity Fuzes for Artillery.—H. Selvidge. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 104–109.) A description of the problems encountered, and the methods used in overcoming them. General details of a proximity fuse suitable for shells of 75 mm calibre and upwards are given. A satisfactory fuse must withstand the high accelerations experienced when the shell is in the barrel (although it is not then operative), and the high spin accelerations throughout its flight; its battery must not deteriorate when stored under adverse conditions; its electrical characteristics must be reproducible, and the polar diagram of the aerial should " roughly match the fragmentation pattern of the projectile ". The fuse described comprises a self-quenched super-regenerative oscillator which acts as transmitter and also as detector for the receiver, the further stages of the latter comprising two RC-coupled pentodes feeding the grid of a thyratron. The latter is normally in the quiescent state, but when an audio-frequency signal of appropriate amplitude is applied to its grid (due to the interaction at the detector of the transmitted signal and that received back from the target) the thyratron fires and sets off the detonating cap. The battery is of the " reserve " type, the electrolyte being kept out of contact with the plates until the instant of firing. The mechanical construction of the fuse is discussed, together with the design of the rugged valves. Methods used in testing the valves and fuses under production conditions are indicated. For a description of a fuse suitable for low-acceleration projectiles, see 624 of March (Huntoon & Miller).

629.13 : 621.38 **1628**

Future of Electronics in Aviation.—J. D. Goodell & D. J. Coleman. (*Radio News*, Feb. 1946, Vol. 35, No. 2, pp. 25..135.) Some applications of wartime developments, *e.g.* radar, control of cabin temperature, autopilots, etc., are discussed. The principle of the ceilometer, a photoelectric device for measuring cloud height, is described.

629.13 : 621.398 **1629**

Radio Target Planes.—(*Radio Craft*, Jan. 1946, Vol. 17, No. 4, pp. 242..279.) A short general account. See also 1323 of May.

639.2 : 621.383 **1630**

Photoelectric Fish Counter.—L. V. Whitney & A. D. Hasler. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 178..182.) The beam from a light source falling on a photocell is interrupted by fish swimming across the beam. The interruptions are observed on a microammeter in a simple amplifier connected to the photocell. The size of catch correlates with the rate of count.

639.3.06 : 621.38 **1631**

Electronic Control of Fish Fence.—(*Electronics*, March 1946, Vol. 19, No. 3, p. 164.) Rapid pulses of special waveform used with an electric fence turn back both small and large fish without harming them.

771.36 : 621.317.39 **1632**

Electronic [camera-] **Shutter-Testers.**—R. F. Redemske. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 128–134.) The first device is a recorder which plots aperture area as a function of time for an iris shutter, and the screen speed at the beginning, middle and end of the traverse for a focal-plane shutter. The delay in functioning of light-operated shutters may also be measured. Teledeltos paper is used for recording, and in the case of the iris shutter, for example, the record consists of ten straight lines drawn parallel to each other and to the direction of uniform motion of the recording paper. Each line corresponds to a definite shutter area, and the length of the line represents the time for which the particular shutter area is exceeded. The curve enclosing the extremities of the lines gives aperture area as a function of time. The result is achieved by a photoelectric cell, voltage dividers and associated amplifiers, the design of which is discussed. The second device gives on a meter the percentage departure of actual shutter speed from rated speed. Here, the photoelectric current is arranged, through suitable amplifiers, to charge a capacitor through a series pentode. The voltage so developed is used as a measure of the time for which the shutter is open.

621.385.833 : 54 **1633**

Major Instruments of Science and Their Applications to Chemistry. [Book Review]—R. E. Burk & O. Grummitt (Eds.). Interscience Publishers Inc., New York, 1945, 151 pp., $3.50. (*Electronic Industr.*, March 1946, Vol. 5, No. 3, p. 153.) Vol. IV in the series " Frontiers in Chemistry ". Contains " Electron Diffraction " by H. Germer, " The Electron Microscope " by L. Marton, " X-Ray Diffraction " by M. L. Huggins, and articles on spectroscopy by W. R. Brode and R. R. Barnes.

PROPAGATION OF WAVES

517.947.4 **1634**

A Method of Solution of Field Problems by means of Overlapping Regions.—Poritsky & Blewett. (*See* 1571.)

621.396[.11 + .81 **1635**

Forecasting Long-Distance Transmission.—W. R. Foley. (*QST*, Feb. 1946, Vol. 30, No. 2, pp. 36–41.) Description of a method using maximum-usable-frequency charts for the determination of optimum frequencies and times for long-distance transmission.

621.396.11 **1636**

I.R.E. Winter Technical Meeting January 1946.—(*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 80..93.) Abstracts are given of the following papers read at the meeting. Field Intensities Beyond Line of Sight at 45.5 and 91 Megacycles.—C. W. Carnahan, N. W. Aram & E. F. Classen. Development in Radio Sky-Wave Propagation Research and Applications during the War.—J. H Dellinger & N. Smith. The Role of Atmospheric Ducts in the Propagation of Short Radio Waves.—J. E. Freehafer. Three- and Nine-Centimetre Propagation Measurements in Low-Level Ocean Ducts.—M. Katzin & R. W. Bauchman. Microwave Propagation: Part I. The Effect of Rain Upon the Propagation of Waves in the One- and Three-Centimetre Region.—S. D. Robertson & A. P. King. Microwave Propagation: Part II. Propagation of Six-Millimetre Waves.—G. E. Mueller. Measurement of the Angle of Arrival of Microwaves.—W. M. Sharpless. For other abstracts see *Electronics*, March 1946, Vol. 19, No. 3, pp. 92..108, and *Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 62..74. For titles of other papers read, see other sections.

621.396.11 **1637**

Curved Earth Geometrical Optics.—G. Millington. (*Marconi Rev.*, Jan./March 1946, Vol. 9, No. 80, pp. 1–12.) " In this paper the effect of the earth's curvature in the geometric-optical treatment of propagation within the visual range is presented as a correction to the flat-earth geometry. Factors to be applied to the flat-earth values of the angle of elevation at the point of reflection and of the path difference between the direct and reflected waves are derived by a single graphical process, and also the divergence factor arising from the increased divergence on reflection from the convex surface of the earth is obtained. Asymptotic values are given for points very near to the horizon."

621.396.11 **1638**

On a Modification of the Interference Method of Investigating the Propagation of Radio Waves.—L. I. Mandelstam & N. D. Papalexi. (*C. R. Acad. Sci. U.R.S.S.*, 1940, Vol. 26, No. 8, pp. 775–779. In English.) The interference method referred to is the measurement of the phase difference between emitted waves and those returned to the sender from a distant "reflector" or re-radiator which transforms the frequency in a simple integral or fraction ratio. The distance of the re-radiator can be found in terms of an unknown whole number of wavelengths and a phase-constant of the apparatus. These unknowns must be determined separately, *e.g.* by a small change of wavelength. It is pointed out that the method is capable of greater accuracy if applied to the determination of small changes of distance, the wavelength being constant, *e.g.* with the re-radiating station on a boat or car. The method was used to determine the mean velocity of radio waves over water (Black Sea, Lake Ilmen, and White Sea) and over land, the distance changes being independently measured by ordinary surveying methods. In the Black Sea measurements the velocity was found to be $(2.999 \pm 0.005)10^{10}$ cm/sec. The land experiments (130–195 m) were carried out to determine the phase structure of the field both in the immediate neighbourhood of the transmitter and at gradually increasing distance from it. Theoretical expectations were confirmed. There was a sharp distortion of the phase structure near a deep ravine. This work is to be described in a separate publication.

621.396.11 **1639**

Influence of the Earth's Surface upon Phase Structure of the E.M. Field of a Radiating Aerial.—J. L. Alpert & V. V. Migulin. (*C. R. Acad. Sci. U.R.S.S.*, 1940, Vol. 26, No. 9, pp. 881–884. In English.) An experimental study of the upward extent of the influence of the earth's surface on the propagation of radio waves. A transmitter on the surface radiated two coherent oscillations with frequencies in the ratio 3/2, (wavelengths 120–180 m and 300–450 m) and observations of the phase difference $\Delta\phi = \phi_1 - 3\phi_2/2$ were made on receivers carried by captive balloons. It was found that the effect of the earth's surface, as shown by the magnitude of $\Delta\phi$, gradually diminishes with increase of height above the earth's surface and practically ceases at a height of about 4λ. The distances at which this effect was observed were about 25–50λ on the shorter wavelengths and 10–20λ on the longer, and the total variation in $\Delta\phi$ was about 30° on the shorter wavelengths and 18° on the longer.

621.396.11 **1640**

Irregularities in Radio Transmission : Part 2.—O. P. Ferrell. (*Radio, N.Y.*, Jan. 1946, Vol. 30, No. 1, pp. 25..63.) Description of several instances of anomalous radar reflections, from clouds, hot air, birds, and auroral ionized regions. For part 1 see 1333 of May.

621.396.11 : 551.51.053.5 **1641**

On the Connection between the Anomalies of Polarization of Half-light and the State of Ionization.—V. M. Bovcheverov, A. V. Mironov, I. M. Mikhailine, V. M. Morozov, Z. L. Ponizovsky, S. P. Sokolov & I. A. Khvostikov. (*C. R. Acad. Sci. U.R.S.S.*, 1940, Vol. 26, No. 9, pp. 900–903. In French.) According to Rayleigh's theory of molecular scattering, the degree of polarization of half-light (dawn and twilight) should decrease uniformly with ϕ the zenithal distance of the sun, according to $p = (1 - \cos^2\phi)/(1 + \cos^2\phi)$, but in fact the polarization shows a well marked minimum. This may be attributable to effects of the ionized layers. The experiments described (simultaneous observations of polarization and of critical frequency of pulsed radio transmissions) were carried out to find whether there was any correlation between ionization and the degree of anomalous polarization. A comparison between the observed decreases of polarization from the theoretical values and the corresponding critical frequencies show that there is such a correlation, *i.e.* the maximum decrease is associated with the highest critical frequencies.

621.396.11.029.62 **1642**

Need There be Line-of-Sight ?—E. P. Tilton. (*QST*, March 1946, Vol. 30, No. 3, pp. 47–50.) A line-of-sight path is not always necessary for good communication in the 144-Mc/s band. Aerial systems are described which have led to improved reception under conditions where the transmitter has been obscured by hills.

631.437 : 621.3.011.2 **1643**

The Use of Cumulative Resistance in Earth-Resistivity Surveys.—Ruedy. (*See* 1523.)

RECEPTION

621.395.8 : 621.395.645 **1644**

Audio Distortion in Radio Reception.—J. Minter. (*Proc. Radio Cl. Amer.*, Jan. 1946, Vol. 23, No. 1, pp. 1–5.) Discussion of transient response and cross-modulation distortion. Cross-modulation between high and low audio frequencies can be reduced by suitable transformer design.

621.396.611.1 : 621.396.621.54 **1645**

Practical Radio Course: Part 41. Analysis of the various causes of drift in the resonance frequency of tuned circuits and in the frequency of the superheterodyne oscillator.—A. A. Ghirardi. (*Radio News*, Feb. 1946, Vol. 35, No. 2, pp. 50..98.) Methods of reducing the effects of temperature, humidity and age, on coils and capacitors. For part 40 of the series see 1342 of May.

621.396.611.1 : 621.396.621.54 **1646**

Practical Radio Course : Part 42. Covering various easily applied methods of minimizing and compensating for oscillator frequency drift in superheterodyne receivers.—A. A. Ghirardi. (*Radio News*, March 1946, Vol. 35, No. 3, pp. 46..100.) For previous parts see 1645 above.

621.396.619.018.41 : 621.396.622 **1647**

Frequency Discriminator.—Bruck. (*See* 1491.)

621.396.62 + 621.396.9 **1648**

Germany's UHF Tubes.—Combined Intelligence Sub-Committee. (*Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 162..168.) A continuation of 1399 of May, dealing very briefly with "radar camouflage" (materials of low radio-reflecting power), and u.h.f. receivers of various types.

621.396.62 **1649**

I.R.E. Winter Technical Meeting January 1946.—(*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 20..93.) Abstracts are given of the following papers read at the meeting. Design of Communication Receivers for the Naval Service with Particular Consideration to the Very-High-Frequency and Ultra-High-Frequency Ranges.—T. McL. Davis. Microwave-Converters.—C. F. Edwards. Tunable Receivers for Very High Frequencies.—G. E. Hulstede, J. M. Pettit, H. E. Overacker, K. Spangenberg & R. R. Buss. Ultra-High-Frequency Television Receivers. — H. T. Lyman. Noise Spectrum of Crystal Mixers.—P. H. Miller. Discriminators for Frequency-Modulation Receivers.—S. W. Seeley. Theory of Impulse Noise in Ideal Frequency-Modulation Receivers.—D. B. Smith & W. E. Bradley. Crystal Rectifiers in Heterodyne Receivers.—H. C. Torrey. For other abstracts, see *Electronics*, March 1946, Vol. 19, No. 3, pp. 92..108, and *Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 62..74. For titles of other papers read, see other sections.

621.396.62 **1650**

CAA Alaskan Diversity Receiving System: Part 1.—Ivers. (*See* 1669.)

621.396.62 **1651**

New Svenskradio Wireless Receivers.—C. Fredin. (*Ericsson Rev.*, 1945, Vol. 22, No. 4, pp. 187–193.) Includes illustrations and a comparative table of details of types 1453, 1454, 1457 and 1458 V(LV).

621.396.62 **1652**

Wide-Range Converter-Receiver.—B. E. Hargrove. (*Radio News*, Feb. 1946, Vol. 35, No. 2, pp. 40–42, 140.) Constructional details of a superregenerative receiver for 112 Mc/s and a 14, 21, 28, 50 Mc/s converter for use with a lower-frequency receiver. High signal/noise ratio, good stability, and freedom from image troubles are claimed.

621.396.62 : 621.317.755 **1653**

Panoramic Reception, 1946.—J. R. Popkin-Clurman & B. Schlessel. (*QST*, March 1946, Vol. 30, No. 3, pp. 22–27.) Description of a receiver adaptor for displaying signals received within a wide frequency band, using a cathode-ray tube with X-deflexion representing signal frequency and Y-deflexion representing signal strength. Pre-war development and wartime applications are reviewed.

621.396.621 : 621.396.619.018.41 **1654**

Frequency Modulation Receiver.—M. Ziegler. (*Radio, N.Y.*, Jan. 1946, Vol. 30, No. 1, p. 41.) The receiver incorporates a feedback arrangement to allow a narrow-band i.f. amplifier to be used, and a frequency-counter circuit is used instead of the conventional discriminator. Summary of U.S. Patent 2 383 359.

621.396.621.029.62 **1655**

144-Mc Radio.—I. Queen. (*Radio Craft*, Jan. 1946, Vol. 17, No. 4, pp. 239..289.) Constructional details of a superregenerative receiver.

621.396.621.029.62 **1656**

A Non-Radiating Superregenerative Receiver for Two Meters.—E. P. Tilton. (*QST*, Feb. 1946, Vol. 30, No. 2, pp. 53..108.) The circuit comprises a tuned r.f. stage, superregenerative detector, and two a.f. stages, all using miniature valves. The receiver is battery-operated, with low current consumption.

621.396.621.029.62 **1657**

Service Considerations in Megacycle Bands.—C. J. Sheridan. (*Radio News*, March 1946, Vol. 35, No. 3, pp. 38..96.) An outline of v.h.f. and f.m. reception techniques.

621.396.621.53 **1658**

Calculation of the Output from Non-Linear Mixers.—Stockman. (*See* 1492.)

621.396.621.54 **1659**

Single Signal C.W. Reception and Crystal Filters.—B.G. (*QST*, March 1946, Vol. 30, No. 3, pp. 59–61.) If the beat-oscillator frequency is set to one side of a narrow i.f. response curve, the heterodyne whistle on one side of the zero-beat position is suppressed.

621.396.621.54 **1660**

Oscillatorless Superheterodyne.—R. W. Woods. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 224..234.) Comprises two mixers, each fed with the signal. The load of one is tuned to intermediate frequency, and is connected to a second input terminal of the other mixer; the load circuit of the latter is tuned to (signal ± intermediate) frequency and is connected to a second input terminal of the first mixer. Output at intermediate frequency is taken from the load circuit of the first mixer. An analogous arrangement may be used as a beat-frequency "oscillator" to follow the i.f. stages of a c.w. morse receiver. Theory and properties of these arrangements are given, with suggested additional applications.

621.396.621.54.029.58 **1661**

A 28-Mc. Receiver/Converter.—B. Goodman. (*QST*, Feb. 1946, Vol. 30, No. 2, pp. 17–20, 106.) Constructional details of an oscillator and frequency converter giving an i.f. of about 1.5 Mc/s, intended to precede an ordinary broadcast receiver.

621.396.622.7 **1662**

Superregenerative Detector Selectivity. — A. Easton. (*Electronics*, March 1946, Vol. 19, No. 3, pp.154–157.) "Experimental determination of characteristics . . . indicates that selectivity and sensitivity increase and noise decreases with decreasing quench frequency. Selectivity decreases with increasing quench amplitude."

621.396.622.7 **1663**

The Application of Modulation-Frequency Feedback to Signal Detectors.—G. Builder. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, March 1946, Vol. 34, No. 3, pp. 130–137.) "Positive modulation-frequency feedback to the load circuit of a signal detector may be adjusted to make the effective modulation-frequency admittance of the load circuit equal to its direct-current conductance, thus eliminating peak clipping and improving the efficiency of detection. Conversely, negative feedback to the detector tends to increase peak clipping. Incidental effects in the amplifier from which the positive feedback voltage is derived may correspond to positive or negative, voltage or current, feedback, depending on the general circuit arrangement. Design formulas and some simple equivalent circuits are given and the major design considerations are outlined. Typical examples include a detector arrangement which provides automatic-volume-control voltages and has a high input impedance and a very low output impedance, as well as Varrell's arrangement which is in agreement with the design procedure outlined in this paper. Attention is also drawn to the great care necessary in the design of detector-amplifier circuits, using multipurpose valves . . . , to avoid distortion due to incidental negative modulation-frequency feedback to the detector." Methods previously suggested for avoiding the type of detector distortion dealt with in the paper are discussed.

621.396.66 **1664**

A.S.C. Radio.—E. Aisberg. (*Radio Craft*, Jan. 1946, Vol. 17, No. 4, pp. 240..263.) Automatic selectivity control is obtained by use of parallel i.f. channels of different bandwidths for the upper and lower audio ranges, the effect being enhanced by crossing the a.v.c. lines.

621.396.822 **1665**

Noise Figures of Microwave Receivers.—W. G. Hawkins. (*Radio, N.Y.*, Jan. 1946, Vol. 30, No. 1, pp. 21..64.) An elementary survey. The noise figure is defined, and its measurement is explained, with numerical examples for typical microwave receivers.

STATIONS AND COMMUNICATION SYSTEMS

621.39 **1666**

I.R.E. Winter Technical Meeting January 1946.—(*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 88..93.) Abstracts are given of the following papers read at the meeting. Phase and Frequency Modulation – A New Method.—R. Adler, F. M. Bailey & H. P. Thomas. Some Technical Developments in Light-Wave Communications.—J. M. Fluke & N. E. Porter. A New System of Angular Velocity Modulation Employing Pulse Techniques.—J. F. Gordon. Naval Warfare Communications Problems.—J. O. Kinert. Two Multichannel Microwave Radio-Relay Equipments for the U.S. Army Communication Network.—R. E. Lacy. Frequency Allocations.—P. D. Miles. For other abstracts, see *Electronics*, March 1946, Vol. 19, No. 3, pp. 92..108, and *Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 62..74. For titles of other papers read, see other sections.

621.395.42 : 534.7 **1667**

Infrasonic Switching.—A. Montani. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 214..222.) It is shown that the ear perceives as continuous a sound which has been suppressed for 0.033 second at a repetition rate of 15 c/s. A system is outlined, utilizing this phenomenon, to give simultaneous two-way communication over a single-channel link.

621.396.1 **1668**

Diversity System.—C. W. Hansell. (*Electronic Industr.*, March 1946, Vol. 5, No. 3, p. 104.) A two-carrier system in which the channels are derived at the transmitter by beating a strong carrier with a weak one (on which the intelligence modulation is superposed) of slightly different frequency. The amplitude modulation due to the mixing process is removed and the resultant phase-modulated carrier (having two principal intelligence-carrying sidebands separated from the carrier by the beat frequency) is fed to the aerial through amplifiers and frequency multipliers. Summary of U.S. Patent 2 388 053.

621.396.1 **1669**

CAA Alaskan Diversity Receiving System: Part 1.—J. Ivers. (*Communications*, Jan. 1946, Vol. 26, No. 1, pp. 40..46.) Technical description, with circuit diagrams, of an 8-channel system using four frequencies between 100 kc/s and 20 Mc/s. A common a.v.c. is used so that a signal received in one channel suppresses the noise from others. The system provides high-speed automatic tape recording up to 250 w.p.m., radio signal relays, or aural reception.

621.396.61 **1670**

Three-Channel 25-Watt Radiotelephone System for Ship-to-Shore.—D. A. Heisner. (*Communications*, Jan. 1946, Vol. 26, No. 1, pp. 32..44.) The system operates on any one of three crystal-controlled frequencies between 2 and 3 Mc/s. The "push to talk" operation is avoided by rectifying part of the speech voltage and using it to operate a relay that activates the transmitter. The transmitter-receiver occupies a space 20″ × 18″ × 9½″, and the power supply 12″ × 10″ × 7½″. It can operate from 6, 12, 32, or 110 V. The circuits are described.

621.396.619.018[.12 + .41 **1671**

"A Review of Frequency Modulated Systems".—A. E. Murphy. (*Proc. Instn Radio Engrs, Aust.*, Nov. 1945, Vol. 6, No. 5, p. 10.) Extract only, dealing with phase modulation.

621.396.619.018.12 **1672**

Further Note on the Phase Modulator and Two Applications.—R. A. Wooding. (*Proc. Instn Radio Engrs, Aust.*, Nov. 1945, Vol. 6, No. 5, pp. 5–8.) A supplement to 2943 of 1945 dealing with a circuit modification, in which grid phase-shift networks are replaced by cathode-circuit reactances, giving phase deviation linear up to a theoretical limit of ± 53 degrees. Application to Armstrong and Chireix systems is described.

621.396.619.018.41 **1673**

Extract from "A Review of Frequency Modulated Systems".—A. E. Murphy. (*Proc. Instn Radio Engrs, Aust.*, Jan. 1946, Vol. 7, No. 1, p. 13.) Non-mathematical outline of the theory of the phase discriminator, using vector diagrams. The use of pre-emphasis and de-emphasis for improving signal/noise ratio is mentioned. Long extract only.

621.396.619.018.41 **1674**

Probable Fallacies and Truths about Frequency Modulation.—E. G. Beard. (*Proc. Instn Radio Engrs, Aust.*, Feb. 1946, Vol. 7, No. 2, pp. 3–14.) Discussion of frequency and phase modulation giving detailed methods and claims of early experimenters. It is shown by diagrams that f.m. gives no advantage over a.m. respecting interference represented by an amplitude-modulated carrier. It is suggested that the high signal/noise ratios of f.m. reception can be achieved by a.m. reception using wide bandwidths and suitable circuits. Non-mathematical explanations are given of five methods of phase-modulating a stabilized frequency.

621.396.619.018.41 **1675**

Fundamental Relationships of F-M Systems.—N. Marchand. (*Communications*, Jan. 1946, Vol. 26, No. 1, pp. 56..61.) Equations for frequency-modulated waves are derived and compared with those for amplitude and phase modulation. This is the first of a series of papers on the operation and design of f.m. transmitters.

621.396.619.16 **1676**

Pulse Modulation.—R. B. Shepherd. (*Wireless Engr*, April 1946, Vol. 23, No. 271, pp. 114–115.) A letter criticizing statements by Roberts and Simmonds in 183 of January. "A chain of rectangular pulses is a succession of discrete phenomena to which the idea of continuous variation cannot be applied." A mathematical method of obtaining the Fourier series of the modulated chain of pulses is outlined.

621.396.619.16 **1677**

PPM — New Technique.—F. Shunaman. (*Radio Craft*, Feb. 1946, Vol. 17, No. 5, pp. 314..359.) An outline of the system of pulse-position modulation with particular reference to the AN/TRC-6 system described in 1056 of April.

621.396.931 **1678**

New Radio Dispatching System.—J. E. Hubel. (*Radio News*, March 1946, Vol. 35, No. 3, pp. 68, 70.) Short general description of the Milwaukee police and fire departments' radio control system.

621.396.933.42 **1679**

The Martin Aircraft H-F Test Network.—F. Albrecht. (*Communications*, Jan. 1946, Vol. 26, No. 1, pp. 15–19, 45.) A general description of the radio equipment used at a small airport and testing ground, including the circuit diagram of a 75-W, 6-channel h.f. radio-telephone transmitter and receiver.

621.396.1 **1680**

Two-Way Radio. [Book Review]—S. Freedman. Ziff-Davis, Chicago, 1946, 506 pp., $5.00. (*Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 153–154.) Deals with the systems and equipment used in two-way or point-to-point communications.

SUBSIDIARY APPARATUS

531.788 + 533.5 **1681**

Audio Aid for Vacuum-Leak Hunting.—Wouk. (*See* 1550.)

535.215 : 621.383 **1682**

Investigation of the Surface Photoelectric Effect of Metallic Films under the Influence of Strong Electrostatic Fields.—Jacobsmeyer. (*See* 1504.)

621.3.087.64 **1683**

Electrodynamic Direct-Inking Pen. — H. B. Shaper. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 148–151.) "Mathematical analysis, choice of drive, constructional details, and performance curves of a high-speed unit capable of inking wave forms of transients directly on a moving paper chart. Response is essentially flat from zero up to 100 c/s." A compact design permits easy construction of multichannel recorders.

621.314.1 **1684**

High-Voltage Rectified Power Supply Using Fractional-Mu Radio-Frequency Oscillator.—R. L. Freeman & R. C. Hergenrother. (*Proc. Inst. Radio Engrs, N.Y.*, Part II, March 1946, Vol. 34, No. 3, pp. 145–147.) A specially designed triode is arranged in a self-biased oscillator circuit operating at a few hundred kc/s, in which the unidirectional voltage built up across the grid leak is many times the applied anode voltage. ". . . the oscillator circuit should have a large voltage step-up ratio from anode to grid and the [valve] amplification factor . . . should be . . . less than unity . . . The transconductance of the tube at small grid voltages should exceed the total circuit conductance." Various experimental valve types are described. Performance figures quoted include :—4.9 kV across a leak of 23.6 MΩ for an anode current of 21.5 mA at 312 V, and 7.75 kV across 12.6 MΩ at 43.0 mA, 485 V anode input.

621.314.22/.23 **1685**

The Impedances of Multiple-Winding Transformers : Part I.—S. A. Stigant. (*Beama J.*, Feb. 1946, Vol. 53, No. 104, pp. 70–74.) Practical formulae used for the predetermination of power-transformer leakage reactances have fundamental academic shortcomings. The reactances may be measured however, and a mathematical analysis shows how they affect the current and voltage equations.

621.314.632 **1686**

A Method for Measuring Effective Contact E.M.F. between a Metal and a Semi-Conductor.—Stephens, Serin & Meyerhof. (*See* 1519.)

621.314.632.029.62 : 546.289 **1687**

Germanium Crystal Diodes.—Cornelius. (*See* 1728.)

621.316.722.078.3 : 621.396.682 **1688**

Voltage-Regulated Power Supplies : Part III.—G. E. Hamilton & T. Maiman. (*Communications*, Jan. 1946, Vol. 26, No. 1, pp. 48–49.) Further details of the equipment described in 1076 of April.

621.316.74 **1689**

Analysis of Operation of a Thermostat with Contact Thermo-Regulator.—Z. Jelonek. (*Proc. Camb. phil. Soc.*, Feb. 1946, Vol. 42, Part 1, pp. 62–72.) Theoretical analysis for the case in which heater current starts and stops suddenly in the form of rectangular pulses.

621.316.86 **1690**

High Stability Carbon Resistors.—G. V. Planer & F. E. Planer. (*Electronic Engng*, March 1946, Vol. 18, No. 217, pp. 66 . . 97.) Description of the manufacture and properties of the pyrolytic or cracked-carbon resistor. The particle size and the choice of a suitable ceramic carrier give a low temperature-coefficient of resistance (0.02–0.07% per deg C). The resistance value is adjusted by grinding a helical groove in the carbon deposit, but this increases the self-inductance. Carbon composition resistors are briefly discussed, and the difficulty of controlling their values is stressed. A new technique of carbon-coating fine carrier particles (*e.g.* quartz) gives improved controllability, but the process is elaborate.

621.317.39.087.4 + 621.3.078 **1691**

Instruments for the Automatic Controlling and Recording of Chemical and other Processes.—D. G. Prinz. (*J. sci. Instrum.*, March 1946, Vol. 23, No. 3, pp. 41–44.) Report of a joint conference of the Institute of Physics, the Institution of Chemical Engineers, and the Chemical Engineering Group (Society of Chemical Industry) held in London on 19th October 1945.

621.317.755 **1692**

A Three-Beam Oscillograph for Recording at Frequencies up to 10,000 Megacycles.—G. M. Lee. (*Proc. Inst. Radio Engrs, N.Y.*, Part II, March 1946, Vol. 34, No. 3, pp. 121–127.) ". . . A description is given of a [continuously evacuated] three-beam high-speed micro-oscillograph which extends the range of application of single-sweep oscillographic recording by a factor of approximately 10 in frequency over previous limits imposed by transit-time distortion. The reduction in deflection sensitivity attributable to transit-time effect is calculated to be 4 per cent at 3 000 megacycles and 40 per cent at 10 000 megacycles. Single-sweep oscillograms of 3 000 and 10 000 megacycle oscillations and breakdown transients with fronts of the order of 10^{-9} second duration are shown." Electromagnetic focusing is used (spot diameter 0.01 mm). Provision is made to prevent fogging of photographs due to light from the filament. Enlargement of the recorded trace by 100 diameters is used and, at this magnification, the sensitivity is 0.1 mm/V. For recording in the microwave region an accelerating voltage of 50 kV is used. At this voltage the total beam current is 5 mA, of which about 2% strikes a triggering probe in the deflexion chamber. The tube is biased to cut off in the stand-by position. For examination of single-stroke phenomena the bias is restored to normal for 1 millisecond; the front edge of the resulting current pulse received by the probe is used to trigger the sweep, the phenomenon to be examined, or both. "The instrument in its present state of development opens up entirely new fields of research. . . . " See also 1976 of 1940 (von Ardenne).

621.317.755.087.5 **1693**

High Speed Photography of the Cathode-Ray Tube.—H. Goldstein & P. D. Bales. (*Rev. sci. Instrum.*, March 1946, Vol. 17, No. 3, pp. 89–96.) Techniques are described for the periodic recording of single traces at rates up to 4 000 per second. Writing speeds as high as 70 cm/μsec can be obtained without sacrifice of sensitivity, using commercial tubes and films. High-speed 16-mm cameras are also described.

621.327.4 **1694**

Gaseous Discharge Tubes and Applications.—Hilliard. (*See* 1729.)

621.352.12 **1695**

Characteristics of Mercury Type Batteries.—(*Electronic Industr.*, March 1946, Vol. 5, No. 3, p. 74.) Short statement of the design and properties of the Ruben-Mallory cell. High ampere-hour-capacity/volume ratio: capacity is the same under continuous and intermittent operation: long shelf life: good performance at high temperatures: low resistance.

621.352.7 **1696**

Dry Battery Characteristics and Applications.—N. M. Potter. (*Proc. Instn Radio Engrs, Aust.*, Jan. 1946, Vol. 7, No. 1, pp. 3–11.) The theory and construction of dry cells is outlined, with mention of the newer flat forms of construction using duplex plates and rubber or plastic seals between cells. This form of construction saves up to 50% in volume and 33% in weight. The measurement of voltage, short-circuit current, and internal resistance is discussed. "The test that best represents any particular service is that which most nearly represents the rate of energy output of the battery when in actual use. There is no direct relation between the results of continuous tests and intermittent tests of longer duration." Curves show the effect of discharge conditions on service life and ampere-hour capacity. Decrease in temperature increases the shelf life but increases the internal resistance, and the cells become useless at about − 21° C, although no permanent damage is done. Applications of cells, and design considerations for battery-operated receivers are reviewed.

621.383.5 **1697**

An Apparatus for Use in the Selection of Barrier-Layer Photocells.—J. A. Hall. (*J. sci. Instrum.*, March 1946, Vol. 23, No. 3, pp. 59–60.) 12 cells mounted in a wheel are in turn balanced in a bridge circuit against a standard cell, all the cells being illuminated by the same source for some time before the comparison is made.

621.385.832 : 621.316.578.1 **1698**

Tube-Seasoning Timer.—M. Silverman. (*Electronics*, Feb. 1946, Vol. 19, No. 2, p. 145.) For applying "seasoning" voltages to batches of about 20 cathode-ray tubes during manufacture. Comprises time switches connected in the electrode circuits, which operate at various times, up to a maximum of 55 min, after the commencement of the seasoning operation.

621.394/.397].645 **1699**

Network Design Using Electrolytic Tanks.—Kenyon. (*See* 1470.)

621.396 **1700**

I.R.E. Winter Technical Meeting January 1946.—(*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 88..93.) Abstracts are given of the following papers read at the meeting. Electrical Characteristics of Quartz Crystal Units and Their Measurement.—W. D. George, M. C. Selby & R. Scolnik. Linear Servo-Theory.—R. E. Graham. A Three-Beam Oscillograph for Recording at Frequencies up to 10 000 Megacycles.—G. M. Lee (See 1692.). Problems Associated with the Standardization of Quartz-Crystal Units for Military Equipment.—C. J. Miller, Jr. Directional Couplers.—W. W. Mumford. High-Frequency Plated Quartz-Crystal Units for Control of Communications Equipment.—R. A. Sykes. Hermetically Sealed Metal Holder for Crystal Units.—A. W. Zeigler. For other abstracts, see *Electronics*, March 1946, Vol. 19, No. 3, pp. 92..108, and *Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 62..74. For titles of other papers read, see other sections.

621.396.662.2 **1701**

Wire Length of Universal Coils.—A. W. Simon. (*Electronics*, March 1946, Vol. 19, No. 3, p. 162.) Procedure for calculating outside diameter and total wire length in terms of number of turns, form diameter, gear ratio and wire size. See also 1085 of April (Simon).

621.398 **1702**

Self-Synchronous Transmission System.—E. Hansen. (*Radio News*, Feb. 1946, Vol. 35, No. 2, pp. 38..143.) The use of the selsyn motor for remote control. Simple diagrams illustrate the basic principles.

TELEVISION AND PHOTOTELEGRAPHY

621.383.8 **1703**

The Image Orthicon.—(*Radio, N.Y.*, Jan. 1946, Vol. 30, No. 1, pp. 10..16.) See also 1376 of May.

621.397 **1704**

I.R.E. Winter Technical Meeting January 1946.—(*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 88..93.) Abstracts are given of the following papers read at the meeting. Television in the Ultra-High Frequencies.—P. C. Goldmark. Ultra-High - Frequency - Television Receivers.—H. T. Lyman. Television-Studio Equipments.—J. J. Reeves. The Image Orthicon, A Sensitive Television Pickup Tube.—A. Rose, P. K. Weimer & H. B. Law. Electro-optical Characteristics of Television Systems.—O. H. Schade. Sight and Sound on One Carrier.—K. Schlesinger. A Kinescope for Home Projection-Type Television Receivers.—L. E. Swedlund. Color-Television Transmitter.—N. H. Young. For other abstracts, see *Electronics*, March 1946, Vol. 19, No. 3, pp. 92..108, and *Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 62..74. For titles of other papers read, see other sections.

621.397 **1705**

A Writing Cathode-Ray Tube.—H. Lineback. (*Radio News*, Feb. 1946, Vol. 35, No. 2, pp. 30, 31, 126.) A device for making a c.r.t. spot follow a predetermined path of arbitrary shape, *e.g.* trace a written word. The required path is translated by a graphical process into an opaque pattern on a transparent disk, something like a variable-width film sound track. The pattern is scanned by two photocells, the outputs from which control the deflector voltages of the c.r. tube.

621.397 **1706**

Television Must Sound Right.—R. Hubbell. (*Radio News*, Feb. 1946, Vol. 35, No. 2, pp. 46..137.) The need for new and spacious studios is stressed. The main points for their design are outlined.

621.397 **1707**

CBS Shows its Color.—(*Electronic Industr.*, March 1946, Vol. 5, No. 3, pp 75..125.) Demonstration of colour television (using rotating colour disk) with sound transmitted by frequency modulation during the fly-back period. A short description of some items of the equipment used.

621.397.3 **1708**

Highlights of Dr. P. C. Goldmark's Paper on Color Television.—R. G. Peters. (*Communications*, Jan. 1946, Vol. 26, No. 1, pp. 50–51.) A brief account of the Baird tri- and di-chromatic systems, a comparison between colour photography and television, and a discussion of the present C.B.S. tri-chromatic system.

621.397.335 **1709**

Facsimile Synchronizing Methods.—D. Schulman. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 131–133.) The required accuracy of synchronization of transmitter and receiver drives is investigated, and methods for obtaining this accuracy are described, ranging from simple manual control at the receiving end, to electronic methods. Self-contained frequency-control systems operate on local standard-frequency sources (tuning fork, or crystal), the phase of receiver and transmitter being matched by a transmitted pulse. Other methods have been devised in which the same audio-frequency tone drives both transmitter and receiver motors, or where each line in the receiver scan is synchronized by a transmitted pulse. Descriptions are given of several devices aimed at stabilization of drive frequencies.

621.397.335 **1710**

Synchronizing and Separation Circuits : Part 12.—E. M. Noll. (*Radio News*, March 1946, Vol. 35, No. 3, pp. 54 . . 60.) For parts 10 and 11 see 782 of March and 1381 of May. (The series does not *begin* with 782 as stated in 1381.)

621.397.335 : 621.396.615.17 **1711**

Synchronizing Generators for Electronic Television.—Applegarth. (*See* 1488.)

621.397.645 **1712**

Compensating Amplifier. — C. N. Gillespie. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 232..234.) To compensate for the distortion produced by the nonlinearity of the recording method and paper of a facsimile system, an equal but opposite nonlinearity is introduced into the amplifier. Summary of U.S. Patent 2 378 999.

621.397.5 **1713**

Television Programming and Production. [Book Review]—R. Hubbell. Murray Hill Books, New York, 1945, 203 pp., $3.00. (*Electronic Engng*, March 1946, Vol. 18, No. 217, p. 96.) " . . . I have not seen a better, or simpler introduction to the peculiar problems which beset the television producer or his team. . . ." See also 785 of March.

TRANSMISSION

621.396.61 + 621.396.645 **1714**

Analysis of Parasitic Oscillations in Radio Transmitters.—J. S. Jackson. (*Radio News*, Feb. 1946, Vol. 35, No. 2, pp. 68 . . 88.) The occurrence and suppression in class-C r.f. amplifiers.

621.396.61 **1715**

I.R.E. Winter Technical Meeting January 1946.—(*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 80 . . 93.) Abstracts are given of the following papers read at the meeting. Generation of Continuous-Wave Power at Very High Frequencies.—W. G. Dow, J. N. Dyer, W. W. Salisbury & E. A. Yunker. Electronic Frequency Stabilization of Microwave Oscillators.—R. V. Pound. Ultra-High-Frequency Television Transmitters and Antennas.—R. Serrell. Color-Television Transmitter.—N. H. Young. For other abstracts, see *Electronics*, March 1946, Vol. 19, No. 3, pp. 92 . . 108, and *Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 62 . . 74. For titles of other papers, see other sections.

621.396.61 : 621.396.619.018.41 **1716**

Twelve-Tube F-M Handie-Talkie.—J. M. Lee. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 194 . . 200.) Weight 8 lb, frequencies 47–55.4 Mc/s, range 1 mile in open country and 300 yd in dense jungle. A U.S. Signal Corps equipment, type AN/PRC-6.

621.396.61 : 621.396.933 **1717**
Low Power Aircraft Transmitter.—A. B. Kaufman. (*Radio News*, March 1946, Vol. 35, No. 3, pp. 29 . . 88.) A 3-Mc/s crystal-controlled transmitter using a suppressor-modulated output valve, has low current consumption and reasonable voice quality.

621.396.61.029.56/.58 **1718**
A Band-Switching V.F.O. Exciter Unit.—W. E. Bradley. (*QST*, March 1946, Vol. 30, No. 3, pp. 29–33.) With calibrated bandspread for 3.5, 7, 14 and 28 Mc/s. Special attention is given to the switching device and mechanical construction. Performance data are given.

621.396.61.029.58 **1719**
350 Watt — 5 Band Transmitter.—H. S. Brier. (*Radio News*, March 1946, Vol. 35, No. 3, pp. 40 . . 125.) Constructional details of a self-contained crystal-controlled transmitter with switched coils for amateur bands from 3.5 to 29.7 Mc/s.

621.396.61.029.58 **1720**
Home Built Signal Shifter.—S. Heytow. (*Radio News*, March 1946, Vol. 35, No. 3, pp. 48 . . 117.) Constructional details of a variable-frequency oscillator for amateur transmitters, giving 20 W output at 20- or 80-metre wavelengths.

621.396.61.029.58 **1721**
A Low Power 28-Mc. 'Phone-C.W. Transmitter.—D. Mix. (*QST*, March 1946, Vol. 30, No. 3, pp. 13–21.) Circuit and constructional details. The power supply unit can be used for either the transmitter or a receiver, by switching. A separate modulator is provided for telephone operation. "Complete equipment for the beginner."

621.396.61.029.62 : 621.396.619.018.41 **1722**
Design of F-M Transmitter for 88-108 Mc.—S. L. Sack. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 184–194.) A high-fidelity transmitter, output 250 W, incorporates balanced modulators, a push-pull primary oscillator, and linear circuit elements in the anode tank circuits. Stable centre-frequency control is obtained by the variation of the primary oscillator tuning capacitance by a motor controlled by the difference in frequency between the primary oscillator and a standard crystal oscillator.

621.396·615.12.029.62 **1723**
144-Mc Transmitter.—I. Queen. (*Radio Craft*, Feb. 1945, Vol. 17, No. 5, pp. 319 . . 363.) Simple description of self-oscillator circuits, using standard receiver-type valves.

621.396.619.2 **1724**
Premodulation Speech Clipping and Filtering.—W. W. Smith. (*QST*, Feb. 1946, Vol. 30, No. 2, pp. 46–50.) By incorporating amplitude limitation, or clipping, and low-pass filtering in an amplitude-modulated transmitter, it is possible to realize an effective power gain of nearly 100 times. The intelligibility of weak signals is greatly increased with a slight loss in quality.

621.396.664 **1725**
Instantaneous Program Switching.—J. Zelle. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 142–144.) Simple circuit for feeding a given wire channel in succession from a number of input channels. "The arrangement has three advantages: circuits can be preset in the order in which they are to be used, so that switching becomes virtually errorless and semi-automatic; secondly the switching will be practically instantaneous . . .; and thirdly, the circuits are interlocked, therefore only one circuit can be put on the outgoing channel at a time."

VALVES AND THERMIONICS

537.525 : 621.3.029.64 **1726**
Initiation of High Frequency Gas Discharges.—T. Holstein. (*Phys. Rev.*, 1st/15th Jan. 1946, Vol. 69, Nos. 1/2, p. 50.) The microwave sparking field in a gas is investigated theoretically as a function of electrode spacing, pressure, electron temperature and Townsend's coefficient α. Summary of an Amer. Phys. Soc. paper.

537.581 **1727**
An Explanation of Anomalous Thermionic Emission Current Constants.—Sun & Band. (*See* 1513.)

621.314.632.029.62 : 546.289 **1728**
Germanium Crystal Diodes.—E. C. Cornelius. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 118–123.) Construction, theory of operation, properties, and typical applications of the rectifier type 1N34. The unit is enclosed in a small metal cylinder with leads for soldering it into circuit. It consists of a tungsten wire touching an optically polished surface of germanium mixed with a small quantity of tin. The equivalent circuit, and the current/voltage characteristics are discussed in relation to the energy levels of the free electrons in the crystal and the tungsten. It is shown that the slope resistance becomes negative when the steady voltage across the device exceeds a particular value that depends on the polarity of the voltage, the temperature, and the particular crystal unit used. The 1N34 is suitable for use as a rectifier for frequencies up to 100 Mc/s, and with low load resistances compares well with a conventional thermionic diode. "Preliminary tests show that no failure or deterioration has occurred for more than 1 000 hours of continuous operation [under adverse conditions]." Other applications, *e.g.* voltage regulation and for relaxation oscillators (up to 500 kc/s) are briefly mentioned. For brief accounts see *Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, p. 80, and *Electronics*, Jan. 1946, Vol. 19, No. 1, p. 252.

621.327.4 **1729**
Gaseous Discharge Tubes and Applications.—R. C. Hilliard. (*Electronics*, March 1946, Vol. 19, No. 3, pp. 122–127.) Details are given of a robust and reliable modulator glow lamp suitable for portable sound-on-film recording systems. The lamp is of the crater type in which the ionization of the gas excites the cathode material, giving a high-intensity point source of light. The neon-filled strobotron designed as a medium-intensity light source for stroboscopic applications is also described. It can be operated either as an arc discharge tube with short-duration high-peak anode currents (300–400 A), or as a glow-discharge tube with low currents, as required in control devices. Other types of this tube have been developed for special features of operation such as

high hold-off voltage (2kV), high repetition rate (1 kc/s), low time-jitter, and high light output, and for use in systems requiring the generation of short current pulses of high intensity (*e.g.* welding control). For photographic analysis of motion and for extremely short exposure photography, a series of externally excited discharge tubes with high light output and short flash-duration have been developed. The design of the discharge circuit is discussed. See also 2351 of 1937 (Edgerton, Germeshausen, Nottingham & White).

621.38 **1730**

I.R.E. Winter Technical Meeting January 1946.—(*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, pp. 80..93.) Abstracts are given of the following papers read at the meeting. Design of Small Size High-Voltage Rectifier Type 1Z2.—G. Baker. Two New Miniature Tubes for Frequency-Modulation Conversion.—R. M. Cohen, R. C. Fortin & C. M. Morris. Microwave Magnetrons. — G. Collins. Improved Cathode-Ray Tubes with Metal-Backed Luminescent Screens.—D. W. Epstein & L. Pensak. A Medium-Power Triode for Frequencies about 600 Megacycles.—S. Frankel, J. J. Glauber & J. Wallenstein. Microwave Triodes Adapted to Modern Usage.—E. M. Goodell. Cascade Amplifier Klystrons.—E. C. Levinthal. Secondary-Emission Cathodes for Magnetrons.—J. W. McNall, H. C. Steele, Jr. & C. L. Shackelford. Glass Problems in the Manufacture of Miniature Tubes.—H. J. Miller. Joint Electron Tube Engineering Council.—O. W. Pike. Magnetron Cathodes.—M. A. Pomerantz. The Image Orthicon, A Sensitive Television Pickup Tube.—A. Rose, P. K. Weimer & H. B. Law. For other abstracts, see *Electronics*, March 1946, Vol. 19, No. 3, pp. 92..108, and *Electronic Industr.*, March 1946, Vol. 5, No. 3, pp. 62..74. For titles of other papers read, see other sections.

621.383.8 **1731**

The Image Orthicon.—(*Radio, N.Y.*, Jan. 1946, Vol. 30, No. 1, pp. 10..16.) See also 1376 of May.

621.385 **1732**

The Resnatron.—W. W. Salisbury. (*Electronics*, Feb. 1946, Vol. 19, No. 2, pp. 92–97.) Constructional details and properties of a very-high-power tunable tetrode suitable for c.w. operation in the decimetre region either as a self-oscillator or as an amplifier. The valve has tuned cavities between directly heated cathode and control grid, and between anode and screen respectively. The tungsten filament requires 2V, 1800 A. Typical plate operating conditions are 8 A, $17\frac{1}{2}$ kV. Under these conditions about 85 kW output may be obtained. The valve described is continuously pumped, and extensive use is made of water cooling. For use in countermeasures operations during the war, see 1356 of May.

621.385 : 621.317.79 **1733**

A Method of Measuring Grid Primary Emission in Thermionic Valves.—Hooke. (*See* 1598.)

621.385.1 **1734**

Reflex-Klystron Oscillators.—E. L. Ginzton & A. E. Harrison. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, March 1946, Vol. 34, No. 3, pp. 97–113.) "A comprehensive analysis of reflex klystrons is developed by considering the electrons as particles acted upon by forces which modify their motion. The analysis is similar to earlier explanations of electron bunching in a field-free drift space and predicts a similar current distribution when bunching takes place in a reflecting field. The effect of the bunched electron beam is treated qualitatively by considering the effect of the beam admittance upon a simple equivalent circuit. A quantitative mathematical analysis based upon oscillator theory is also derived and the results are presented in a series of universal curves which are used to explain the operating characteristics of these tubes. Power output, efficiency, starting current, electronic tuning, and modulation properties are discussed. Some general remarks on reflex-oscillator design considerations are also included." The effect of transit time across the gap of the resonator is considered. The equivalent circuit mentioned above comprises a parallel LC circuit representing the resonator, connected in shunt with the equivalent admittance of the bunched beam and with resistances to simulate circuit losses and loading. The design criteria for reflex klystrons designed to have wide-band electronic tuning are discussed relative to considerations of power output and efficiency.

621.385.1 : 537.122 : 538.3 **1735**

"Electron Transit Time in Time-Varying Fields".—L. A. Ware & H. B. Phillips: A. B. Bronwell. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, March 1946, Vol. 34, No. 3, p. 151.) Comments on 3884 of 1945 (Bronwell).

621.385.1 : 621.365.52 **1736**

Induction Heating in Radio Electron-Tube Manufacture.—Spitzer. (*See* 1615.)

621.385.1.032.2 + 533.5 + 539.234 **1737**

Fine Wires in the Electron-Tube Industry.—Espersen. (*See* 1564.)

621.385.2 : 621.395.645.3 **1738**

A Voltage Amplifier Using a Pre-Saturation Diode as Load.—Durnford. (*See* 1478.)

621.385.832 : 621.316.578.1 **1739**

Tube-Seasoning Timer.—Silverman. (*See* 1698.)

MISCELLANEOUS

061.22 : 621.396(054) **1740**

Waves and Electrons.—The journal which appeared with this title in Jan. and Feb. 1946, is continued as "*Proc. Inst. Radio Engrs, N.Y.*, Part II," from March 1946. See 1122 of April.

621.38/.39] (038) **1741**

Electronics Dictionary. [Book Review]—N. M. Cooke & J. Markus. McGraw-Hill, New York, 1945, 433 pp., $ 5.00. (*Electronic Industr.*, Dec. 1945, Vol. 4, No. 12, p. 162. Also *Electronics*, Jan. 1946, Vol. 19, No. 1, pp. 344..348.)

621.38 (075.8) **1742**

Electronics Laboratory Manual. [Book Review]—R. R. Wright. McGraw-Hill Book Co., New York, 77 pp., $ 1.00 (*Waves and Electrons*, Feb. 1946, Vol. 1, No. 2, p. 103.)

621.396.029.64 **1743**

Radiation Laboratory Technical Series. [Book Notice]—(*See* 1549.)

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534.21 **1744**

Sound Radiation from a Source Placed in Water at a Small Depth.—L. M. Brekhovskikh. (*C.R. Acad. Sci. U.R.S.S.*, 30th May 1945, Vol. 47, No. 6, pp. 396–399. In English.) If the depth of the water is large compared with the distance from source to receiver, the sound pressure at the receiver varies as the inverse square of the distance; for water of depth small compared with the sender-receiver distance, and with a perfectly reflecting bottom the pressure varies as the inverse square root of the distance. In both cases the pressure increases with depths of source or receiver to a distance approximately equal to a quarter of a wavelength. The case of a source attached to a solid submerged hemisphere is discussed briefly. For description of confirmatory experiments see 1745 below.

534.21 **1745**

Radiation of a Sound in Water as affected by Depth of Submersion.—N. N. Andreyev, L. M. Brekhovskikh & L. D. Rosenberg. (*C.R. Acad. Sci. U.R.S.S.*, 30th May 1945, Vol. 47, No. 6, pp. 400–402. In English.) Description of experiments carried out to confirm the theory put forward by Brekhovskikh (see 1744 above). The experimental curves follow the theoretical curves well, and variations about them can be explained by interference due to multiple reflections between bottom and surface. The maximum sound pressure is attained at a depth of a quarter of a wavelength, as predicted by theory.

534.24 **1746**

Acoustic Reflection from Triplanes, Spheres, and Disks.—C. J. Burbank. (*Phys. Rev.*, 1st/15th Feb. 1946, Vol. 69, Nos. 3/4, p. 136.) ". . . reflection from a triplane (an object made of three mutually perpendicular square plates with coinciding centres) is compared [experimentally] with the back reflection from a sphere and a disk." Abstract of an Amer. Phys. Soc. paper.

534.26 **1747**

On Diffraction of Elastic Waves.—Scherman. (*See* 1906.)

534.321.9 **1748**

Ultrasonic Generator.—F. W. Smith, Jr. & P. K. Stumpf. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 116–119.) The basic piezoelectric transducer is an X-cut quartz crystal excited in the thickness mode and loaded (usually) with transformer oil, which has high acoustic resistance and good dielectric properties. The design of a crystal holder with an airpocket which makes the radiation unidirectional is described. The crystal, which may be 10 cm in diameter, is silver plated and clamped at its edge.

The input impedance is equivalent to about 10 000–250 000 Ω shunted by about 100 μμF. Methods of matching this to the usual class-C amplifier are discussed, and a π-matching network is favoured. The r.f. generator may be crystal-controlled, but the radiating crystal may not be used, as its frequency varies with loading. Frequencies used are usually 150–1 000 kc/s, but frequencies up to 500 Mc/s have been used.

534.321.9 : 534.2 **1749**

A Variable Path Ultrasonic Interferometer for the Four Megacycle Region with Some Measurements on Air, CO_2, and H_2.—J. L. Stewart. (*Rev. sci. Instrum.*, Feb. 1946, Vol. 17, No. 2, pp. 59–65.) Alignment of the piston and crystal to the order of 10^{-5} inch in this interferometer gave an accuracy of 0.1% in the measurement of velocity in gases, and of 50% in the measurement of absorption and reflection coefficients. Preliminary measurements on H_2 gave evidence of molecular dispersion in the range 4–8 Mc/s.

534.417 : 534.88 **1750**

Sonar for Submarines.—R. S. Lanier & C. R. Sawyer. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 99–103.) Description of an underwater sonic and supersonic listening system. The pickup, a magnetostriction hydrophone, incorporates a magnetized nickel tube 3 ft long and 2 inches in diameter. The hydrophone output is taken to a 5-stage resistance-coupled amplifier supplying a loudspeaker or headphones. The amplifier has 5 frequency-response characteristics, any one of which may be selected. The sensitivity is about 20 db above that required to raise the water noise to audibility. A frequency converter may be switched into the circuit to reduce the frequencies of supersonic signals to below 5 kc/s.

534.417 : 621.396.9 : 355.326.4 **1751**

The Sonobuoy.—K.H. (*See* 1855.)

534.43 : 621.395.61 : 621.396.619.018.41 **1752**

An FM Phono Pickup.—A. Badmaieff. (*Radio Craft*, Nov. 1945, Vol. 17, No. 2, p. 106.) An application of 1144 of May.

534.833.1 **1753**

Demountable Soundproof Rooms.—W. S. Gorton. (*Communications*, March 1946, Vol. 26, No. 3, pp. 30, 33.) See 825 of April.

621.395[.61 + .625 **1754**

A.I.E.E. Winter Convention January 1946.—(*Elect. Engng, N.Y.*, Jan. 1946, Vol. 65, No. 1, pp. 29..35.) Abstracts are given of the following papers presented at the convention:—Inertia Throat Microphones, by E. H. Greibach & L. G. Pacent. Laboratory Method for Objective Testing of Bone Receiving and Throat Microphones, by E. H. Greibach. A New Wire-Recorder-Head Design, by T. H. Long. A B-H Curve Tracer for Magnetic-Recording Wire, by T. H. Long & G. D. McMullen. Signal and Noise Levels in Magnetic Tape Recording, by D. E. Wooldridge. Phonograph Reproducer Design, by W. S. Bachman. Recently Developed Tools for the Study of Disk-Recording Performance, by H. E. Roys. Sound Recording in Business, by L. D. Norton. Titles of other papers are given in other sections. For other abstracts, see *Electronics*, April 1946, Vol. 19, No. 4, pp. 230..266.

621.395.61 **1755**

Microphones: Parts 1 & 2.—S. W. Amos & F. C. Brooker. (*Electronic Engng*, April & May 1946, Vol. 18, Nos. 218 & 219, pp. 109–111 & 136–141.) 1. It is shown that the basic differential equations for the oscillations in electrical, mechanical and acoustic systems are similar in form. The electrical equivalents of various acoustic networks consisting of combinations of cavities, tubes and slits are given, with indication of how they may be applied to microphone design.

2. The mechanisms of pressure-operated and velocity-operated (differential) microphones are analysed, and typical response curves given.

621.395.61 : 621.395.623.8 **1756**

Microphone Design in Electric Megaphones [to reduce acoustic feedback].—A. J. Sanial. (*Communications*, Feb. 1946, Vol. 26, No. 2, pp. 30..61.) See also 17 of January.

621.395.645.3 : 621.385.4 **1757**

Intermodulation Tests for Comparison of Beam and Triode Tubes used to drive Loudspeakers.—Hilliard. (*See* 2043.)

621.395.665 **1758**

Contrast Expansion.—Parnum. (*See* 1793.)

621.395.665 **1759**

Contrast Expansion.—White. (*See* 1792.)

621.395.667 **1760**

Paraphase Bass-Treble Tone Control.—D. L. Jaffe. (*Radio, N.Y.*, March 1946, Vol. 30, No. 3, pp. 17, 51.) A detailed account of a single RC network, giving an independent variation in bass and treble response about an arbitrary cross-over frequency in the a.f. spectrum.

621.395.667 **1761**

Improved [tone] **Compensator.**—F. C. Davis. (*Radio Craft*, March 1946, Vol. 17, No. 6, p. 425.) Independent bass and treble control are achieved by splitting the signal between two channels, in which these controls are respectively situated, and afterwards recombining the two outputs.

621.395.667 : 534.43 : 621.395.61 **1762**

High Fidelity Bass Compensation for Moving Coil Pick-Ups.—F. M. Haines. (*Electronic Engng*, April 1946, Vol. 18, No. 218, p. 121.) Correction to a circuit diagram in 833 of April. For an illustrated summary of the original article see *Radio, N.Y.*, March 1946, Vol. 30, No. 3, p. 4. (Note correction of wrong UDC number applied to 833 of April.)

621.395.92 + 621.396.62 **1763**

Radio Hearing Aid.—A. Montani. (*Radio Craft*, March 1946, Vol. 17, No. 6, pp. 392, 438.) Description and circuit diagram of a combined hearing aid and pocket radio.

AERIALS AND TRANSMISSION LINES

621.315.21.029.6 : 621.396.9 **1764**

Radar Cables—Recent Developments in Conductors for Very High Frequencies.—E. W. Smith. (*Wireless World*, April 1946, Vol. 52, No. 4, pp. 129–131.) The chief objective in development was reduction in the power factor of the dielectric. This was achieved first by making air-dielectric cables and later by the use of polythene. With polythene, much progress has been made in manufacturing methods, especially in the avoidance of air inclusion, and in attaining the accurate uniformity of diameter necessary to reduce standing waves. Some special types of cable (*e.g.* delay and low-impedance types) are mentioned, and methods of mechanical and electrical testing briefly described.

621.315.211.2.029.5/.6 **1765**

Applications of High-Frequency Solid-Dielectric Flexible Lines to Radio Equipment.—H. Busignies. (*Elect. Comm.*, 1945, Vol. 22, No. 4, pp. 295–301.) A review of the present and past needs for flexible moisture-proof r.f. lines. The polystyrene dielectric formerly used has largely been replaced by polyethylene. The mechanical and electrical requirements are detailed, together with the corresponding methods of test. The importance of electrical balance and stability of electrical length is emphasized, particularly in relation to directional systems used for navigation and aircraft landing.

621.315.212.1 **1766**

Flexible Coaxial Cable.—R. M. Krueger. (*QST*, April 1946, Vol. 30, No. 4, pp. 51–53.) A survey of solid-dielectric concentric and unscreened twin cables using polyethylene as dielectric. A list of abridged specifications of U.S. Army-Navy standard coaxial cables is given.

621.315.213.14.017.2 **1767**

Determination of the Temperature Rise and the Maximum Safe Current through Multiconductor Electric Cables.—H. P. Iskenderian & W. J. Horvath. (*J. appl. Phys.*, April 1946, Vol. 17, No. 4, pp. 255–262.) The temperature rise in rubber-insulated cables is calculated using the thermal constants of the cable. The theory has been confirmed experimentally and the thermal resistivity constants obtained as a function of size and composition. The maximum safe current to limit the temperature rise at the centre to 25°C is predicted.

621.396.611.029.63/.64] : 621.392 **1768**

Semi-Transparent Oscillating Electromagnetic Cavities.—Kahan. (*See* 1795.)

621.396.67 + 621.396.11 **1769**

The Ratio between the Horizontal and the Vertical Electric Field of a Vertical Antenna of Infinitesimal Length Situated above a Plane Earth.—K. F. Niessen. (*Philips Res. Rep.*, Oct. 1945, Vol. 1, No. 1, pp. 51–62.) The Hertzian vector function is simplified (for the case of a radio landing beacon) by considering the observer to be a large number of wavelengths away from the emitting aerial and relatively close to the reflecting earth. The reflection formula so derived is only applicable under certain conditions of height and angle of elevation which are deduced. The resulting horizontal to vertical field ratio is obtained, and is shown to be reduced when the aerial is raised a little above the ground.

621.396.67 **1770**

The General Reciprocity Theorem in the Theory of Receiving and Transmitting Antennae.—J. N. Feld. (*C.R.Acad. Sci. U.R.S.S.*, 10th September 1945, Vol. 48, No. 7, pp. 476–478. In English.) "The reciprocity theorem for two arbitrary antennae in the case of harmonic oscillations of one and the same frequency f is written . . . $I^{(1)} E_1 = I^{(2)} E_2$, where $I^{(1)}$ and $I^{(2)}$ are the currents passing through the terminals of the first and second antennae when operating as receiving aerials, and E_1 and E_2 are the total e.m.f.s of the generators connected to the terminals of the antennae when the latter are operating as transmitting aerials. . . [This theorem] holds, however, only under the condition that the internal (complex) resistances of the generators z_1 and z_2 corresponding to the resistances of the receivers $Z^{(1)}$ and $Z^{(2)}$ . . . are equal." The more general case, when the condition is not fulfilled, is considered in this paper.

621.396.67 **1771**

The Thin Cylindrical Antenna: A Comparison of Theories.—D. Middleton & R. King. (*J. appl. Phys.*, April 1946, Vol. 17, No. 4, pp. 273–284.) The solutions of Hallén's integral equation given by Hallén (2763 of 1939), Bouwkamp (2197 of 1944), Gray (1931 of 1944), King & Middleton (1453 of June) are compared together and with Schelkunoff's transmission-line theory (1049 of 1942 and 1930 of 1944) and with experiment. The King-Middleton second-order theory agrees best with experimental results. It is concluded that the integral-equation method of Hallén leads to a satisfactory theory of the thin cylindrical aerial.

621.396.67 **1772**

I.R.E. Winter Technical Meeting 1946.—(*Communications*, Feb. 1946, Vol. 26, No. 2, pp. 22 . . 66.) Abstracts of some of the papers read. For titles, see 1448 of June.

621.396.676 : 621.396.932.029.54 **1773**

Radiation of Ship Stations on 500 Kc/s.—Marique. (*See* 2071.)

621.396.677 **1774**

A Theory for Three-Element Broadside Arrays.—C. W. Harrison, Jr. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, April 1946, Vol. 34, No. 4, pp. 204–209.) "The vector relationship between the voltages that must be applied across the terminals of a three-element array, to maintain input currents of the same amplitude and phase, is determined. Each antenna is of half-length h, and of radius a. The spacing between antennas is b. Two broadside arrays having the following dimensions are analysed numerically: (*a*) $h = \lambda/2$, $b = \lambda/2$, and $\Omega = 2 \ln (2h/a) = 20$; (*b*) $h = \lambda/4$, $b = \lambda/2$, and $\Omega = 20$. The results of these calculations are supplied in the form of vector diagrams."

621.396.677.029.62 **1775**

A V.H.F. Directive Antenna System.—A. Niutta. (*Communications*, Feb. 1946, Vol. 26, No. 2, pp.18–20.) A simple unidirectional aerial system for 100 Mc/s is obtained by using a pair of horizontal centre-fed full-wave dipoles, side by side, spaced a quarter of a wavelength apart. Transformer connexions are such that there is a $\pi/2$ phase difference between the two dipoles. The theory of the design is given, and alternative means of obtaining the required phasing are discussed.

621.396.677.029.64 : 564.566 **1776**

Laguerre Functions in the Mathematical Foundations of the Electromagnetic Theory of the Paraboloidal Reflector.—Pinney. (*See* 1909.)

CIRCUITS

621.3.011.2 : 621.385.2 **1777**

Radio Design Worksheet: No. 46—Non-Linear Resistance.—(*Radio, N.Y.*, March 1946, Vol. 30, No. 3, pp. 31–32.) Consideration of the relationships between current, p.d., and power in a diode for d.c. and a.c. excitation.

621.3.012.8 : 512.831 **1778**

Tensors and Equivalent Circuits.—Hoffmann. (*See* 1898.)

621.318.572 **1779**

Signalling System.—R. F. Massoneau. (*Radio, N.Y.*, March 1946, Vol. 30, No. 3, p. 28.) A method of counting the number of cycles in a pulse of electrical energy, suitable for use in transmission of numerical data. Summary of U.S. Patent 2 379 093.

621.318.572 : 621.317.755 **1780**

Four-Channel Electronic Switch.—N. A. Moerman. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 150–153.) To enable 4 signals, whose frequencies need not be related, to be viewed simultaneously on a single-beam tube. The inputs are applied to gate amplifiers which are switched at 25 kc/s by a crystal-controlled ring counter. The latter allows accurate measurement of short time intervals. Useful resolution is obtainable well above commercial power frequencies.

621.385.38 : 621.396 **1781**

Thyratrons and Their Applications to Radio Engineering.—Maddock. (*See* 2090.)

621.392 + 621.396.622 + 621.396.64 **1782**

I.R.E. Winter Technical Meeting 1946.—(*Communications*, Feb. 1946, Vol. 26, No. 2, pp. 22..66.) Abstracts of some of the papers read. For titles, see 1462 of June.

621.392.4.012 **1783**

Graphical Solution of Series Circuits.—P. K. Hudson. (*Communications*, March 1946, Vol. 26, No. 3, pp. 48–49.) It is shown that a simple chart for converting polar coordinates into rectangular coordinates can be applied to circuit problems concerning series resistances and reactances.

621.392.43 **1784**

Conjugate-Image Impedances.—S. Roberts. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, April 1946, Vol. 34, No. 4, pp. 198–204.) An analysis of the power in a load connected to a signal generator by a four-terminal network, in relation to the matching of generator and load to the conjugate impedance of the network terminals. The power gain (*i.e.* ratio of power in the load to power available from the generator) is calculated, with discrimination between ultimate, available, and actual gains, corresponding respectively to the cases of conjugate-impedance match at both output and input of the network, at the output only, and at neither output nor input. The analysis is applied to an oscillator problem.

621.392.5 **1785**

Transient Delay Line.—J. M. Lester. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 147–149.) Design criteria for a pulse-delay network. If the highest-frequency component of the transient is known, a simple graphical solution is possible for the values of inductance and capacitance.

621.392.5 **1786**

Solving 4-Terminal Network Problems Graphically.—R. Baum. (*Communications*, March 1946, Vol. 26, No. 3, pp. 50..53.) The networks contain either lumped or distributed constants. The use of the Smith diagram (1372 of 1939) and of inversion diagrams is explained in detail.

621.392.52 **1787**

A.I.E.E. Winter Convention January 1946.—(*Elect. Engng, N.Y.*, Jan. 1946, Vol. 65, No. 1, pp. 29..35.) Abstracts are given of the following papers presented at the convention :—A Tunable Rejection Filter, by R. C. Taylor. A New Crystal Channel Filter for Broad-Band Carrier Systems, by E. S. Willis. Titles of other papers are given in other sections. For other abstracts see *Electronics*, April 1946, Vol. 19, No. 4, pp. 230..266.

621.394/.395].645.34 **1788**

Graphical Analysis of Degenerative Amplifiers.—R. G. Middleton. (*Radio, N.Y.*, March 1946, Vol. 30, No. 3, pp. 23–24, 50.) A current-feedback amplifier is analysed by making certain algebraic transformations on the characteristic curves of the valves. The technique can also be applied to voltage feedback.

621.394/.397].645.2 **1789**

Wide-Band Amplifiers : Part 2.—(*Wireless World*, April 1946, Vol. 52, No. 4, pp. 125–126.) Broadening the bandwidth by critical mistuning or stagger gives a higher gain per stage than does increase of damping in coincidence-tuned stages. For part 1 see 1190 of May.

621.394/.397].645.3 **1790**

Shifting Concepts.—" Cathode Ray". (*Radio, N.Y.*, March 1946, Vol. 30, No. 3, pp. 6..12.) Illustrated summary of 1192 of May (" Cathode Ray ") on negative feedback.

621.395.645.3 : 621.385.4 **1791**

Intermodulation Tests for Comparison of Beam and Triode Tubes used to drive Loudspeakers.—Hilliard. (*See* 2043.)

621.395.665 **1792**

Contrast Expansion.—J. G. White. (*Wireless World*, April 1946, Vol. 52, No. 4, pp. 120–123.) Circuits described in 3489 and 3929 of 1945 (White) use variable negative feedback to produce contrast expansion ; a slight modification of these eliminates unwanted current-feedback and can lead to 8 db increase in expansion. The effect of control bias on reproduction distortion is discussed at some length. An error in one of the earlier papers (3489 of 1945) is pointed out. See also 1793 below.

621.395.665 **1793**

Contrast Expansion.—D. H. Parnum. (*Wireless World*, April 1946, Vol. 52, No. 4, p. 136.) Discussion of 3489 and 3929 of 1945 (White). See also 1792 above.

621.396.6.018.1 **1794**

Phase Relationships.—C. E. Cooper. (*Wireless World*, April 1946, Vol. 52, No. 4, pp. 127–128.) When considering the difference between grid and anode signals it is better to use the term " reversed polarity " than " 180 degrees out of phase ".

621.396.611.029.63/.64] : 621.392 **1795**

Semi-Transparent Oscillating Electromagnetic Cavities.—T. Kahan. (*C. R. Acad. Sci., Paris*, 4th April 1945, Vol. 220, No. 14, pp. 496–497.) A cavity is said to be semi-transparent if part of its wall is made of a partly-reflecting film, *e.g.* a very thin metal film on a low-loss dielectric base. A cavity consisting of a metal cylinder closed at one end by a thin film and at the other by a reflecting piston can be made, by proper choice of the film density and piston position, to be a non-reflecting termination to a waveguide. Other applications of partly reflecting films for matching discontinuities in waveguide circuits are briefly mentioned.

621.396.615 **1796**

Three-Phase R-C Oscillator for Radio and Audio Frequencies.—H. Rakshit & K. K. Bhattacharyya. (*Sci. Culture*, March 1946, Vol. 9, No. 9, pp. 509–510.) A three-stage resistance-coupled amplifier with regenerative feedback made with suitable component values is shown to have two possible stable modes of oscillation. The normally favoured mode generates a radio frequency ; on suppressing this, by means of a simple adjustment, the audio frequency is obtained. In the example quoted, the two frequencies were about 2 Mc/s and 250 c/s.

621.396.615.14.029.63 **1797**

Coaxial Butterfly Circuits.—E. E. Gross, Jr. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 156–160.) Wide-frequency-range circuits for use with the 2C43 lighthouse valve are described and illustrated. A theoretical chart showing the resonant frequency as a function of the loading capacitance for various Z_0 is given, and is useful for design. A typical circuit gave 1 000–1 300 Mc/s and a power of 0.3–0.7 W at 250 V, for use in a beat-frequency oscillator for obtaining low-frequency pulses with rapid build-up. A wide-range oscillator covering 620–1 340 Mc/s is also described. The arrangements for the output coupling loop and the possibility of extending the circuits to higher frequencies are discussed. See also 3260 of 1945 (Karplus). Abstracts noted in 884 of April and 1209 of May.

621.396.615.17 **1798**

Multivibrator Theory.—S. C. Snowdon. (*Phys. Rev.*, 1st/15th Feb. 1946, Vol. 69, Nos. 3/4, p. 134.) "The transient response of a symmetrical multivibrator has been analysed neglecting the effect of shunt capacities and grid current." Abstract of an Amer. Phys. Soc. paper.

621.396.615.17 : 621.317.755 **1799**

Time-Base Converter and Frequency-Divider.—Moss. (*See* 2093.)

621.396.619.16 **1800**

Pulse [width] **Modulation.**—A. T. Hickman. (*R.S.G.B. Bull.*, April 1946, Vol. 21, No. 10, pp. 150–153.) A typical modulation circuit is described, and the frequency spectrum analysed.

621.396.645.3.029.5 **1801**

Station Design and Planning: Part 2—The Power Amplifier.—W. H. Allen. (*R.S.G.B. Bull.*, Jan. 1946, Vol. 21, No. 7, pp. 103-105.) An elementary account of the design of a low-power transmitter, including considerations of valve type, biasing, and anode circuit. For part 1 see 1058 of April, for parts 3, 4 and 5 see 2067 and 1980.

621.396.66 : 621.385.2 **1802**

Limiting Circuits.—J. McQuay. (*Radio Craft*, March 1946, Vol. 17, No. 6, pp. 396..427.) An explanation of the principles, using a diode as a limiter, and description of various forms of limiting actions.

621.396.662 **1803**

The Design of Band-Spread Tuned Circuits for Broadcast Receivers.—D. H. Hughes. (*J. Instn elect. Engrs*, Part III, March 1946, Vol. 93, No. 22, pp. 87–96.) The design of preselector and oscillator circuits is discussed. The basic circuit for band-spread tuning by variable capacitance is analysed, formulae are developed for calculating the elements of the capacitance network, and graphical methods of solution are developed and illustrated. The use of temperature-compensated capacitors, and methods of circuit trimming are discussed.

621.396.662.34 **1804**

H.F. Band-Pass Filters: Part 4.—H. P. Williams. (*Electronic Engng*, May 1946, Vol. 18, No. 219, pp. 158–162.) Gives a practical example of band-pass design. For previous parts see 1498 of June and back references.

621.396.69 **1805**

Printed Electronic Circuits.—Brunetti & Khouri. (*See* 1887.)

621.318.7 **1806**

An Introduction to the Theory and Design of Electric Wave Filters. [Book Review]—F. Scowen. Chapman & Hall Ltd., London, 1945, 164 pp., 15s. (*Engineering, Lond.*, 22nd Feb. 1946, Vol. 161, No. 4180, p. 171. *Elect. Rev., Lond.*, 25th Jan. 1946, Vol. 138, No. 3557, p. 146. *Electronic Engng*, May 1946, Vol. 18, No. 219, p. 164.)

GENERAL PHYSICS

535.312/.313 **1807**

Fresnel's Formulae for the Reflection of Light and the Misunderstandings in Their Application.—T. Kravetz. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 59.) Abstract of a paper of the Acad. Sci., U.S.S.R.

535.37 **1808**

The Phosphorescence of Various Solids.—J. T. Randall & M. H. F. Wilkins. **Phosphorescence and Electron Traps: I & II.**—J. T. Randall & M. H. F. Wilkins. **Short Period Phosphorescence and Electron Traps.**—G. F. J. Garlick & M. H. F. Wilkins. (*Proc roy. Soc. A*, 6th Nov. 1945, Vol. 184, No. 999, pp. 347–364, 365–389, 390–407 & 408–433.)

535.43 **1809**

On the Problem of the Diffuse Reflection of Light.—V. Ambarzumian. (*J. Phys., U.S.S.R.*, 1944, Vol. 8, No. 2, pp. 65–75.) Previous solutions ignore the effect of multiple scattering which is included in the present analysis for the case of a medium in plane parallel layers. The indicatrix (the angular distribution of the scattered rays in the elementary process) is assumed to be spherical. The reflection coefficient r, and R ($= 4\eta r/\lambda$) are calculated in terms of functions of η ($= \cos\theta$) and η_0 ($= \cos\theta_0$), where θ and θ_0 are the angles between the normal and the reflected and incident rays respectively ($\lambda =$ coefficient of pure scattering/sum of coefficients of absorption and pure scattering).

Lambert's empirical law that the coefficient of brightness ($\rho = r/\eta$) is constant for white bodies ($\lambda \approx 1$) is found theoretically to hold when ρ is averaged over all azimuths and for angles of incidence and reflection not too large ($\theta, \theta_0 \not> 70°$).

537.525 **1810**

On the Kinetic Theory of an Assembly of Particles with Collective Interaction.—A. Vlasov. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, pp. 25–40.) Usually, in the collision theory of the many-body problem, the long range forces (operating at distances greater than the mean particle spacing) are neglected. By taking account of these forces it is shown that new dynamic properties of polyatomic systems are revealed, such as eigenfrequencies, a quasi-crystal structure in gases, and the presence of currents in a medium due to collective interaction of the particles. There is previous work on the subject by Vlasov in *Zh. eksp. teor. Fiz.*, 1938, Vol. 8, p. 291.

537.525 **1811**

Oscillation and Relaxation Processes in the Electron Plasma of the Discharge.—E. Adirovich. (*C. R. Acad. Sci. U.R.S.S.*, 20th Sept. 1945, Vol. 48, No. 8, pp. 551–554. In English.) A theoretical consideration of the processes of propagation of small disturbances in the plasma leads to conclusions that longitudinal density oscillations on a frequency higher than that deduced by Langmuir are possible. The theory also deals with the development of relaxation processes in the plasma.

537.525 **1812**

Disintegration of the Plasma of a Low-Pressure Electrical Discharge.—V. L. Granovsky. (*J. Phys., U.S.S.R.*, 1944, Vol. 8, No. 2, pp. 76–88.) An investigation of the deionization of gas in a discharge tube after the electric field is removed. Expressions are derived theoretically for the rates of decrease of the temperature and concentration of the electrons, which are initially exponential. The decrease of the velocities of the ions is much more rapid than that of the electrons, and the ambipolar diffusion coefficient D_{am} decreases relatively slowly. The effect of fresh ionization during the process is practically negligible.

The plasma disintegration of Hg vapour in cylindrical tubes of 65 and 105 mm diameter at various pressures from 2.3 to 65 μ Hg was investigated experimentally. A 50-c/s recurrent technique with oscillographic display was used, and the p.d. across a low resistance in the probe circuit was passed to the c.r.o. through a d.c. amplifier. The ionization decreased in the predicted manner, and the time constant τ_0 of the initial process was computed and found to be in good agreement with the value derived from D_{am} in stationary processes. 37 references are given.

537.525 **1813**

Propagation of Waves and Retardation of Electron Beams in Plasma.—E. Adirovich. (*C. R. Acad. Sci. U.R.S.S.*, 30th Sept. 1945, Vol. 48, No. 9, pp. 630–632. In English.) Sequel to 1811 above.

537.525 : 621.3.015.532 **1814**

Variation of the Mobility of Negative Ions in Strong Fields and the Influence of this Variation on the Characteristics of the Corona Discharge.—A. Kaptzov. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, pp. 62–63.) Abstract of a paper of the Acad. Sci., U.S.S.R.

537.525.8 **1815**

Cathode Dark Space and Negative Glow of a Mercury Arc.—C. G. Smith. (*Phys. Rev.*, 1st/15th Feb. 1946, Vol. 69, Nos. 3/4, pp. 96–100.) Discussion of an experimental attempt to distinguish between field and emission theories of electron liberation. The voltage gradient at the cathode surface is deduced from accurate measurements of the thickness of the cathode dark space. " The inferred voltage gradient at the cathode is entirely too small for the field theory of electron liberation, and . . . [furthermore] a powerful ionizing agent must be operative . . . at the . . . [cathode] surface."

537.591 **1816**

On the Existence of Highly Ionizing Particles in the Soft Component [of cosmic rays]. —A. Alichanian, A. Alichanow & S. Nikitin. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, pp. 56–58.)

541.14 **1817**

Some Observations on the Inner Photoeffect in Crystals of Alkali-Halide Salts.—N. Kalabuchov. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, pp. 41–44.) It is suggested that light may induce the formation of colloid particles in crystals at low temperatures, a phenomenon already known to exist at high temperatures. Measurements of the saturation current due to photoconductivity in crystals of alkali-halide salts seem to indicate an effect similar to the Ramsauer effect which occurs in gases.

621.315.61 + 537.226] : 536.2 **1818**

On the Thermal Conductivity of Dielectrics at Temperatures Lower than that of Debye.—I. Pomeranchuk. (*J. Phys., U.S.S.R.*, 1942, Vol. 6, No. 6, pp. 237–250.) Theoretical analysis extending the previous work of Debye and Peierls and including the effect of the scattering of elastic waves (phonons) at impurities (*e.g.* chemical, lattice defects, isotopes). The results are shown graphically where the conductivity K is given as a function of the absolute temperature T and of the relative concentration of the impurities ϵ. For values of ϵ greater than a critical concentration ϵ_0 the conductivity is proportional to $L^{\frac{1}{2}}/T^{\frac{1}{2}}$ where L is the linear dimension of the crystal. Over a certain range of low temperatures K is proportional to $L^{\frac{1}{2}}$ but independent of T, an effect observed experimentally for diamond for $T = 24–343$°K. This temperature range is wide for dielectrics with high Debye temperatures, but may be absent when the Debye temperature is low and ϵ is small. At very low temperatures, where the free path of the phonons is of the order of L, the conductivity varies as LT^3 (*e.g.* diamond below 10°K). The effect of crystal twinning is discussed briefly and found to be unimportant in the case of sodium chloride.

621.383.2 + 535.215.1 **1819**

Complex Photoelectric Cathodes.—N. Khlebnikov. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 63.) A new conception of complex cathode emitters, in which the emission is considered as the external photoelectric effect of semiconductors possessing unusually low values of the work function. Abstract of a paper of the Acad. Sci., U.S.S.R.

621.385.833 : 537.533 **1820**

Field-Emission of Electrons.—Lukirsky. (*See* 1952.)

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.7 + 550.38]" 1945.10/.12 " **1821**

Solar and Magnetic Data, October to December, 1945, Mount Wilson Observatory.—S. B. Nicholson & E. S. Mulders. (*Terr. Magn. atmos. Elect.*, March 1946, Vol. 51, No. 1, pp. 55–56.)

523.7 : [525.23 + 525.24 **1822**

A Possible Atmospheric Solar Effect in Both Geomagnetism and Atmospheric Electricity.—O. R. Wulf. (*Terr. Magn. atmos. Elect.*, March 1946, Vol. 51, No. 1, pp. 85–87.) " In the average behaviour of the daily variation of the horizontal magnetic force there appears in the summer months a recognizable effect [a maximum] which occurs at closely the same universal time [2000 GMT] at Cheltenham (Maryland), Tucson (Arizona) and Honolulu (Hawaii) . . ." which suggests " . . . something unusual in the reaction of the Earth to solar radiation when the Sun is over the longitude . . 105° to 120° west."

523.72 : 621.396.822 **1823**

Radio-Frequency Energy from the Sun.—J. L. Pawsey, R. Payne-Scott & L. L. McCready. (*Nature, Lond.*, 9th Feb. 1946, Vol. 157, No. 3980, pp. 158–159.) An account of observations of radiation from the sun on a wavelength of 1.5 metres during October 1945. The mean intensity is correlated with the total sunspot area. It is suggested that " cosmic static " originating in the region of the Milky Way may be attributed to similar bursts of radiation from stars, caused by gross electrical disturbances analogous to terrestrial thunderstorms. See also 1824/1826 below, and 323 of February (Appleton).

523.72 : 621.396.822 **1824**

Noise Observed during Radio Fade-Out, August 17, 1945.—J. M. Watts. (*Terr. Magn. atmos. Elect.*, March 1946, Vol. 51, No. 1, pp. 122–125.) Observations made at ionospheric station at Maui, Hawaii.

523.72 : 621.396.822 **1825**

Solar Radiations in the 4-6 Metre Radio Wave-Length Band.—J. S. Hey: F. J. M. Stratton. (*Nature, Lond.*, 12th Jan. 1946, Vol. 157, No. 3976, pp. 47–48.) Radiation of the order of 10^5 times the power expected, assuming the sun to behave as a black-body radiator, was observed on Army radar equipments on 27–28th February 1942, and appeared to be associated with a big solar flare occurring at that time.

523.72 : 621.396.822 **1826**

Short-Wave Radio Emission from the Sun.—(*Engineering, Lond.*, 15th Feb. 1946, Vol. 161, No. 4179, p. 164.) A brief account.

523.72 : [550.38 + 551.51.053.5 **1827**

Variation of the Sun's Ultra-Violet Radiation as Revealed by Ionospheric and Geomagnetic Observations.—C. W. Allen. (*Terr. Magn. atmos. Elect.*, March 1946, Vol. 51, No. 1, pp. 1–18.) From a study of critical frequency variations (E, F_1 and F_2) at Washington, Huancayo, Watheroo and Mount Stromlo (1937–44) and of variations in the S_q magnetic field at Apia, Watheroo and Cape Town (1937–43) it is concluded " (*a*) The variable part of the Sun's ultra-violet illumination comes mainly from active regions characterized by the appearance of sunspots, flocculi, and faculae. (*b*) The sources of ultra-violet have a longer life than sunspots, and possibly a longer life than faculae. (*c*) The three ionospheric layers E, F_1 and F_2, and the S_q field are influenced by the same sources of ultra-violet light. (*d*) The sources emit considerable ultra-violet radiation when at the centre of the Sun and probably emit some radiation when near the limb. (*e*) F_2 electrons take periods of one or two days to reach equilibrium concentration—at the level of S_q currents recombination is much more rapid. (*f*) The variable part of the ultra-violet flux is proportional to sunspot-number, and is about equal to the steady part at sunspot-maximum. This applies to radiation exciting the E-, F_1-, and F_2-regions. (*g*) There is a linear relation between $f^0{}_{F_2}$ and sunspot-number. (*h*) Faculae could produce continuous ultra-violet radiation that might account for ionospheric and geomagnetic variations."

523.74 : 550.38 **1828**

Distribution of Solar Eruptions in Relation to Magnetic Storms.—P. Bernard. (*C. R. Acad. Sci., Paris*, 4th April 1945, Vol. 220, No. 14, pp. 506–508.) Eruptions in the central zone of the solar disk have a preponderating influence on terrestrial magnetism because they are apparently more frequent and greater in extent. It seems that apart from this effect of geometrical position, no part of the sun is more effective than another as regards eruptions and related geomagnetic disturbances.

523.746 " 1945.10/.12 " **1829**

Provisional Sunspot-Numbers for October to December, 1945.—M. Waldmeier. (*Terr. Magn. atmos. Elect.*, March 1946, Vol. 51, No. 1, p. 36.)

523.746.5 **1830**

An Addition to the Table of Secular Variations of the Solar Cycle.—W. Gleissberg. (*Terr. Magn. atmos. Elect.*, March 1946, Vol. 51, No. 1, p. 121.) Addition to the table given in 1388 of 1945. The epoch of the last sunspot minimum is taken as 1944.2, and the smallest relative sunspot number is 7.7, giving 1923.5 for the epoch of the secularly smoothed minimum of 1923. This confirms the existence of a long period (about 80-year) cyclical variation of the 11-year cycle.

523.78 : [551.51.053.5 + 621.396.11 **1831**

The Solar Eclipse of 1945 and Radio Wave Propagation.—R. L. Smith-Rose. (*Nature, Lond.*, 12th Jan. 1946, Vol. 157, No. 3976, pp. 40–42.) A preliminary summary of observations made in Britain. Ionospheric soundings showed a reduction in ionization before the optical eclipse, which may be associated with a corpuscular eclipse, though the main reduction of 30–45% occurred during the optical eclipse. Similar effects were also observed in the U.S.S.R. Ionospheric absorption at vertical incidence at 2 Mc/s was reduced by roughly 10 db. Long-distance communication showed a small but definite decrease in absorption in the band 60 kc/s–1 Mc/s. Long-distance direction-finding observations and v.h.f. propagation measurements showed no appreciable change.

523.78 : 551.51.053.5 **1832**

Scientists' Study of Last Solar Eclipse.—S. P. Chakravarti. (*Curr. Sci.*, Nov. 1945, Vol. 14, No. 11, p. 283.) Brief account of the radio investigations on the ionosphere during the eclipse of July 1945.

525 + 526 + 55 + 91] : 001.4 **1833**

Some Thoughts on Nomenclature.—S. Chapman. (*Nature, Lond.*, 30th March 1946, Vol. 157, No. 3987, p. 405.) 'Geonomy', analogous to 'astronomy', is suggested as a comprehensive word covering all the studies of the earth such as geography, geophysics, etc. 'Aeronomy' is suggested to replace meteorology.

550.38 **1834**

Induction Effects in Terrestrial Magnetism: Part 1—Theory.—W. M. Elsasser. (*Phys. Rev.*, 1st/15th Feb. 1946, Vol. 69, Nos. 3/4, pp. 106–116.) A mathematical paper dealing with the electromagnetic effect of motions in the earth's core, considered as a fluid metallic sphere. " The secular variation of the [terrestrial magnetic] field is interpreted as a modification of the current system caused by inductive interaction between mechanical motions of the fluid and the magnetic field."

550.38 "1941/1944" **1835**

Three-Hour-Range Indices, *K*, of Geomagnetic Activity at the Magnetic Observatory, Hermanus, Comparison with *K*-Indices at American-Operated Observatories, and Mean *K*-Indices, K_A, for the Years 1941-44.—A. Ogg. (*Terr. Magn. atmos. Elect.*, March 1946, Vol. 51, No. 1, pp. 75–83.)

550.38 "1945" **1836**

American Magnetic Character-Figure C_A, Three-Hour-Range Indices, K, and Mean K-Indices, K_A, for October to December, 1945, and Summary for Year 1945.—W. E. Scott. (*Terr. Magn. atmos. Elect.*, March 1946, Vol. 51, No. 1, pp. 57–66.)

550.38 "1945" **1837**

The Spherical Harmonic Analysis of the Earth's Magnetic Field for the Epoch 1945.—V. I. Afanasieva. (*Terr. Magn. atmos. Elect.*, March 1946, Vol. 51, No. 1, pp. 19–30.)

551.51.052 **1838**

Radiative Equilibrium of the Atmosphere and the Thermal Structure of the Troposphere. — R. Ananthakrishnan. (*Curr. Sci.*, Nov. 1945, Vol. 14, No. 11, pp. 298–299.) An analysis of records from sounding balloons released at Agra over a number of years shows a thermal structure of the upper troposphere with marked lapse-rates and inversions; this can be explained by the existence of a heat-emission layer, as postulated by Albrecht (1931 Abstracts, p. 493).

551.51.053.5 **1839**

Cause and Effect in Region F_2 of the Ionosphere.—J. Bannon & F. W. Wood. (*Terr. Magn. atmos. Elect.*, March 1946, Vol. 51, No. 1, pp. 89–102.) From an analysis of $f^0_{F_2}$ values for ionosphere stations in the neighbourhood of latitude 35° it is concluded that "(*a*) There is a variation, in the composition of region F_2, from place to place over the Earth's surface. (*b*) The annual effect found by Berkner and Wells may be due to the variation in composition of region F_2, and to the differences in $\bar{s} \cos^{\frac{1}{2}} \bar{\chi}$ in the two hemispheres. (*c*) The annual effect has not a sidereal cause. (*d*) As far as annual mean values of maximum electron-density are concerned, the transition from noon to midnight is not influenced by the number of sunspots. (*e*) If the thermal-expansion hypothesis is correct, midnight temperatures are probably low, and do not vary much throughout the year. Summer-noon temperatures are very much higher than temperatures at midnight."

551.51.053.5 : 621.396.11 **1840**

Intense Scatter in E_s-Region at Christmas Island.—R. C. Peavey. (*Terr. Magn. atmos. Elect.*, March 1946, Vol. 51, No. 1, pp. 126–127.) Very marked scattering of sporadic-E echoes has been observed. It occurs mainly in the frequency band 3.7–4.4 Mc/s, and occasionally at higher frequencies. It occurs regularly during daylight hours, but only infrequently at night.

551.51.053.5 : 621.396.11 **1841**

Low-Level Reflections Observed at Christmas Island.—R. C. Peavey. (*Terr. Magn. atmos. Elect.*, March 1946, Vol. 51, No. 1, pp. 125–126.) A report on weak echo signals from apparent heights of 40–70 km on frequencies between 1.0 and 2.0 Mc/s, observed during daytime in June 1945. Signals cannot have been reflected from terrestrial objects, because of the isolation of the island. The possibility of reflections from heavy cloud formation is mentioned.

621.396.11 : 551.53.051.5 **1842**

Short Period Fluctuations in the Characteristics of Wireless Echoes from the Ionosphere.—Eckersley & Farmer. (*See* 1968.)

621.396.91.087.5 : 551.51.053.5 **1843**

A Simple Kerr Modulator for Ionospheric Recording.—Rydbeck. (*See* 2049.)

551.57 : 621.396.82 **1844**

Precipitation Static.—(*See* 1991/1993.)

LOCATION AND AIDS TO NAVIGATION

534.417 : 534.88 **1845**

Sonar for Submarines.—Lanier & Sawyer. (*See* 1750.)

621.383 : 551.576 **1846**

The Cloud Range Meter.—Moles. (*See* 1943.)

621.396.9 **1847**

A.I.E.E. Winter Convention January 1946.—(*Elect. Engng*, Jan. 1946, Vol. 65, No. 1, pp. 29..35.) Abstracts are given of the following papers presented at the convention :—Techniques and Facilities for Microwave Radar Testing, by E. I. Green, H. J. Fisher & J. G. Ferguson. Radar Systems Considerations, by D. A. Quarles. Marine Radar for Peacetime Use, by L. H. Lynn & O. G. Winn. Air-Borne Radar for Navigation and Obstacle Detection, by R. C. Jensen & R. A. Arnett. Shoran Precision Radar, by S. W. Seeley. The SCR-584 and SCR-784 Equipments, by M. R. Briggs. Titles of other papers are given in other sections. For other abstracts see *Electronics*, April 1946, Vol. 19, No. 4, pp. 230..266.

621.396.9 **1848**

The Decca Navigator.—M. G. Scroggie. (*Communications*, March 1946, Vol. 26, No. 3, pp. 21–24.) For another account see 1242 of May.

621.396.9 **1849**

Radar Navigation.—(*Electrician*, 10th May 1946, Vol. 136, No. 3545, pp. 1245–1246.) A short account of the reading before the Radio Section of the I.E.E. of papers on radar navigation, Gee, Oboe (ground-controlled precision bombing aid), H_2S (airborne navigation and bombing aid), and radar interrogator-beacon systems. The respective authors were R. A. Smith, R. J. Dippy, F. E. Jones, C. J. Carter, and K. A. Wood.

621.396.9 **1850**

I.E.E. Radiolocation Convention.—(*Electrician*, 29th March & 5th April 1946, Vol. 136, Nos. 3539 & 3540, pp. 798–810 & 887–892.) A summary of the proceedings. The main contributions dealt with developments of aerials and waveguides; importance of meteorological factors in propagation; applications and developments of c.r. tubes, discussion of trace visibility and use for display; difficulties in precision radar, and range and azimuth measurement; development of u.h.f. valves, and the outstanding value of the magnetron; u.h.f. measurements and test gear; decimetre- and metre-wave transmitters and receivers; applications of radar to navigation and gunnery.

621.396.9 **1851**

Radar Technique.—H. Stoelzel. (*Schweiz. Bauztg*, 1st Dec. 1945, Vol. 126, No. 22, pp. 249–252. In German.) A short and elementary account of the basic principles of radar sets and of their applications in war and peace.

621.396.9 **1852**

Radiolocation or Radar.—R. L. Smith-Rose. (*R.S.G.B. Bull.*, Feb. 1946, Vol. 21, No. 8, pp. 119–125.) Optical methods are used to illustrate the underlying principles. Historical development is traced from early ionosphere experiments to centimetre radar. Reference is also made to location by sound.

621.396.9 **1853**

Radar Countermeasures.—(*Engineer, Lond.*, 7th Dec. 1945, Vol. 180, No. 4691, pp. 460–461.) Outline account of ground-based and airborne operations which were successful in reducing the efficiency of German radio communication and radar systems. "Hoaxing" operations connected with D-day are described in some detail.

621.396.9 (091) **1854**

The Historical Development of Radar.—E. G. Bowen. (*Proc. Instn Radio Engrs, Aust.*, March 1946, Vol. 7, No. 3, pp. 3–9.) Abstract of lecture and discussion before the Institution. Radar developments in England and U.S. during the war are outlined. Radar was in early use in Germany but research ceased in 1941. Japanese radar and its operational use were very backward.

621.396.9 : 355.326.4 : 534.417 **1855**

The Sonobuoy.—K. H. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 154–155.) Description of an expendable radio transmitter, modulated by signals from an underwater magnetrostriction hydrophone, for revealing the presence of submerged submarines to patrol ships and aircraft.

621.396.9 : 523.3 **1856**

Radar Echoes from the Moon.—J. Mofenson. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 92–98.) Experiments by the U.S. Signal Corps using considerably modified radar equipment. The crystal-controlled transmitter was operated at 111.5 Mc/s with a pulse recurrence period of 4 seconds and pulse lengths of 0.02–0.25 sec at 3 kW power. The crystal-controlled receiver had a noise factor of 7 db (using 2 grounded-grid r.f. stages) and a band-width of 50 c/s for maximum sensitivity. The aerial system with 8 × 8 horizontal dipoles in a vertical plane gave a beam width of 15°, and was only suitable for use at times near moonrise and moonset. Assuming no attenuation in space the calculated signal/noise ratio was 20 db, which checked closely with experiment. The anticipated delay time of 2.4 sec and Doppler frequency shift due to the moon's radial velocity were observed.

621.396.9 : 621.385.832 **1857**

Cathode-Ray Tube Displays.—J. G. Bartlett, D. S. Watson & G. Bradfield. (*Electronic Engng*, May 1946, Vol. 18, No. 219, pp. 143–150.) The displays are classified as conventional, pictorial, realistic, or instructional, and are further classified as general or precision. The principles of all displays are given, with more detailed descriptions of operational displays developed in the period 1936–1945. Methods of improving the visibility of the tube traces are discussed. Long summary of a paper read at I.E.E. Radiolocation Convention.

621.396.9 : 621.385.832 : 778 **1858**

Use of Film in Radar Training.—(*Electronic Engng*, May 1946, Vol. 18, No. 219, p. 150.) Records made on film are used to control dummy p.p.i. displays for training operators. The process is very briefly described.

621.396.9 : 629.13 **1859**

Radar for Civil Aviation.—R. A. Smith. (*Nature, Lond.*, 9th Feb. 1946, Vol. 157, No. 3980, pp. 151–153.) An outline of the difficulties of applying war-time radar methods and navigation aids to civil flying. Considerations of "pay-load" and number of crew limit the equipment that can be carried. Possible uses of existing equipment are given, and unsolved problems are discussed.

621.396.91 **1860**

More on Spherics, Storm Detector.—U.S. Signal Corps. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 224..228.) An account of a low-frequency (3.6–17.5 kc/s) crossed-loop c.r.d.f. receiver for instantaneous indication of sources of atmospherics.

621.396.93 **1861**

Radio Direction Finder.—D. G. C. Luck. (*Radio, N.Y.*, March 1946, Vol. 30, No. 3, p. 29.) Compensating lines counteract the effect of pickup on the transmission line shields of a shielded-U Adcock system. Summary of U.S. Patent 2 387 670.

621.396.932 + 621.398 **1862**

The Engineering Work of the Clyde Lighthouses Trust.—D. A. Stevenson. (*Engineer, Lond.*, 23rd & 30th Nov. 1945, Vol. 180, Nos. 4689 & 4690, pp. 425–426 & 443.) An historical account, including notes on the remote radio control of fog signalling equipment, and the application of synchronous sound and radio signals for distance measurement.

621.396.933 **1863**

F. M. Radar Altimeter.—D.G.F. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 130–134.) An airborne f.m. transmitter is used to obtain reflection from the ground; the height of the aircraft is determined by the average frequency difference of the transmitted and received signals, as given by the average beat frequency produced on combining them. The transmitter frequency is 440 ± 20 Mc/s, with modulation frequency 120 c/s, which gives an average beat note of 19 c/s per foot of altitude. This system is used up to a height of 400 ft, above which the frequency deviation is reduced to 2 Mc/s.

The transmitter is modulated mechanically, a 120-c/s oscillator driving one capacitor plate in the tank circuit of the transmitter by means of a loudspeaker voice-coil assembly. A push-pull triode oscillator is used giving about 100 mW. The receiver detector mixes the reflected signal with a signal taken directly from the transmitter, and a d.c. voltage proportional to the resulting beat frequency is obtained from counter circuits.

The equipment is designated AN/APN-1.

621.396.933.2 : 621.396.91 **1864**

The Application of Ultra-Short-Wave Direction Finding to Radio Sounding Balloons.—R. L. Smith-Rose & H. G. Hopkins. (*Proc. phys. Soc.*, 1st March 1946, Vol. 58, Part 2, No. 326, pp. 184–200.) A pre-war investigation of the possibilities of determining wind velocities at high levels. The accuracy of the direction-finding technique used for taking bearings on the signals from balloon transmitters is discussed in relation to accuracy of location of the balloon. Direction finders using closed loops and spaced aerials working on wavelengths between 8 m and 10 m were used. After correcting for the ground calibration, the probable error of mean observed bearings was about 0.3°.

621.396.933.23 **1865**

[U.S.] **Army Air Forces' Portable Instrument Landing System.**—S. Pickles. (*Elect. Comm.*, 1945, Vol. 22, No. 4, pp. 262–294.) A very detailed technical and theoretical description of a mobile (truck-borne) equipment comprising a "localizer" on 108–110 Mc/s, a "glide-path" on 332–335 Mc/s, and three "marker" beacons on 75 Mc/s. The localizer radiator is a linear array of five horizontal broad-band square-loop elements, a main group of three, and an auxiliary group of two. Modulation, at 90 and 150 c/s, is by a mechanical system (a rotor which periodically tunes and distunes a stub-line). A system of balanced bridges divides and distributes the carrier and sideband energies between the elements of the array, with suitable phase differences. Only the centre element of the main group carries both carrier and sidebands. The others are fed with the sidebands only, phased to give the necessary balance of the 90-c/s and 150-c/s polar diagrams about a vertical plane containing the axis of the array (see also 1548 of June). A dipole monitor set, located at some distance from the transmitter, responds to any change in the course marked by the localizer which lasts more than a few seconds, by switching off the transmitter and giving bell and light warning signals.

The glide-path radiator system has two elements, the lower about 4–6 ft above the ground, and the upper about 25 ft above it. The upper radiator is a 60° V-shaped dipole with a linear parasitic dipole reflector, with a similar system a half-wavelength above it. The lower is essentially a square loop radiator bisected by a vertical reflecting screen. The glide-path is equi-signal for the 90 and 150 c/s modulations of the upper and lower radiators.

The marker beacons, at the approach end of the runway, at 1 mile, and at 4½ miles distance, are modulated with a 3 000 c/s tone, 1 300 c/s dots, and 400 c/s dashes respectively. They project narrow bands of radiation across the localizer course, and give the pilot his distance from the landing runway.

621.396.933.23 **1866**

Use of Microwaves for Instrument Landing: Part 1.—D. F. Folland. (*Radio, N.Y.*, March 1946, Vol. 30, No. 3, pp. 18–22, 47.) The value of using sharp microwave beams for producing precision courses, unaffected by weather or by buildings, is discussed. A Sperry system of two mobile ground transmitters, suitable for the blind landing of aircraft, is described in some detail.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788 : 539.164.92 **1867**

Radium-Type Vacuum Gage.—G. L. Mellen. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 142–146.) Ionization of the gas is caused by the radiation from a sealed radium source. The construction of the gauge and associated high-gain d.c. amplifier is described. The gauge has scale ranges 0–0.1, 0–1, 0–10 mm Hg.

533.55 **1868**

The Theory of the Mercury-Vapour Vacuum Pump and a New High-Speed Pump.—P. Alexander. (*J. sci. Instrum.*, Jan. 1946, Vol. 23, No. 1, pp. 11–16.) "Theoretical considerations and experimental results show that the pumping effect of a mercury-vapour pump, usually called a 'diffusion pump', is not explained by Gaede's theory of the diffusion principle. Starting from Langmuir's condensation principle the same considerations lead to a different theory; a new pump has been designed on the basis of this theory. This pump has a volumetric pumping speed of the order of 1 000 L/sec, and its effective working range extends from the lowest pressures up to 10^{-1} mm of mercury."

533.56 **1869**

On the Theory of Diffusion Pump.—K. Ray & N. D. Sen Gupta. (*Indian J. Phys.*, Aug. 1945, Vol. 19, No. 4, pp. 138–145.) Experiments show that the pressure can be reduced far below the vapour pressure of the pumping fluid. The success of a diffusion pump depends largely on jet design.

535.37 **1870**

Phosphorescence.—Randall, Wilkins & Garlick. (*See* 1808.)

535.37 + 621.385.832 **1871**

Uniform Luminescent Materials.—C. G. A. Hill. (*Science*, 8th Feb. 1946, Vol. 103, No. 2667, pp. 155–158.) Discussion of the luminescent characteristics of various inorganic solids, and a theoretical outline of the relation of these properties to the composition and method of preparation. Details are given of the preparation of suitable examples of the silicate, tungstate and sulphide classes.

537.525 : 621.3.029.5 **1872**

Probe Method in the Study of High Frequency Discharges.—N. R. Tawde & G. K. Mehta. (*Sci. Culture*, March 1946, Vol. 9, No. 9, pp. 485–488.) Analysis is made of the techniques employed by various investigators. Summarized results indicate a close analogy between the h.f. discharge and a d.c. discharge under similar conditions, and suggest a Maxwellian distribution of electron velocities. Suggestions are made for improvements in further work.

548.0 : 061.6 : 621.386 **1873**

Recent Research Work in the Davy Faraday Laboratory.—K. Lonsdale. (*Nature, Lond.*, 23rd March 1946, Vol. 157, No. 3986, pp. 355–357.) The substance of a lecture at the Royal Institution. Three main lines of research are indicated: Studies of the vibrations of atoms in crystals; of the subcrystalline changes which occur at the transition points of certain crystals such as Rochelle salt, KH_2PO_4, and KH_2AsO_4; of the texture of various crystals, by means of Laue photographs and of divergent X-ray beam photographs.

Progress is noted in the application of the technique of X-ray scattering and in the interpretation of the complex phenomena observed. In the case of Rochelle salt the change in crystalline structure associated with the very marked changes in dielectric and piezoelectric properties is accomplished by a change of axial angle of only 2′ of arc. The anomalies appear to be due to changes in the length of the hydrogen bonds, combined with changes in the mobility of the hydrogen atoms.

549.514.1 : 537.228.1 **1874**

Control of Electrical Twinning in Quartz.—W. A. Wooster & N. Wooster: L. A. Thomas, J. L. Rycroft & E. A. Fielding. (*Nature, Lond.*, 30th March 1946, Vol. 157, No. 3987, pp. 405–406.) The electrical twinning of quartz can be eliminated by suitable combinations of stress and temperature. The method can be applied to most of the rotated

Y-cut plates, including the BT-cut (but not the Y-cut itself or the Z-cut), with so high a proportion of successes that the large-scale processing of quartz plates is practicable.

549.514.1 : 621.396.611.21 **1875**

Crystal Grinding Without Tears.—F. R. Cowles. (*QST*, April 1946, Vol. 30, No. 4, pp. 48–50.) Hints on how to grind and clean AT- and BT-cut crystals. Activity can be increased by edge-grinding or by changing electrodes.

621.3(213) **1876**

Tropical Moisture and Fungi: Problems and Solutions.—E. S. McLarn, H. Oster, H. Kolin & A. Neumann. (*Elect. Comm.*, 1945, Vol. 22, No. 4, pp. 303–313.) A comprehensive and detailed review of the effects of tropical conditions on radio and electrical components and materials, and the means of protection against them. The protective measures include initial design, selection of suitable materials, and the use of fungicidal coatings. Moisture proofing is the prime necessity and requires hermetic sealing in many cases. Recommended materials at the present time include ceramics having a glazed finish, porcelain, glass, and glass-bonded mica. Plastic sleeving of the polyvinyl-chloride type has proved preferable to fabric and cellulose-acetate sleeving.

Details are given of the nature, characteristics, and limitations of the three main types of fungicidal agents — phenyl mercurials, chlorinated phenols, and salicylanilides.

The advances made in this technique during the war open up new possibilities of development in regions where climatic conditions had previously prevented the use of modern technical equipment.

See also 1561 (Prentice) and 1562 (Leutritz & Herrmann) of June.

621.3.011.2 : 546.49–1 **1877**

The Temperature Dependence of the Resistance of Liquid Metals at Constant Volume.—S. Gubar & I. Kikoin. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, pp. 52–53.) Experiments on the resistance of a column of mercury completely filling a closed stout-walled glass capillary tube are briefly described, from which it is concluded " . . . it may be regarded as directly proved that for mercury the increase of resistance normally observed with temperature rise is associated exclusively with the effect of its thermal expansion. . . . It should be noted that . . . with an appropriate selection of the glass used it is possible to make the resistance of the specimen entirely independent of temperature."

621.3.011.2 : 546.87 **1878**

Negative Resistance-Temperature Coefficient of Thin Evaporated Films of Bismuth.—T. J. Tulley. (*Nature, Lond.*, 23rd March 1946, Vol. 157, No. 3986, p. 372.) A letter briefly describing observations. Films of bismuth were evaporated on to microscope slides at a pressure of about 10^{-3} mm Hg using a mercury diffusion pump without a trap. Values of the resistance-temperature coefficient for various thicknesses of film are tabulated, giving a peak value of -31.2×10^{-4} per °C, for an estimated film thickness of 1.5 microns, which falls to -20.8×10^{-4} for a thickness of about 0.03 microns and to -16.8×10^{-4} for a thickness of 6.5 microns. Some values of the (positive) coefficient for other metals are added for comparison.

621.315.551 : 621.396.823 : 621.365 **1879**

Interference with Broadcast Reception by Electrical Heating Apparatus.—Gerber & Werthmüller. (*See* 1996.)

621.315.58.029.54/.64 **1880**

The Electrical Properties of Salt-Water Solutions Over the Frequency Range 1-4 000 Mc/s.—R. Cooper. (*J. Instn elect. Engrs*, Part III, March 1946, Vol. 93, No. 22, pp. 69–75.) Stationary-wave measurements with a parallel-wire transmission line have been made to determine the refractive index and absorption coefficient of solutions of salt in concentration up to 4% in the frequency band 690–4 320 Mc/s. The conductivities were obtained in the range 0.95–13 Mc/s by measuring the change in Q of a resonant circuit shunted by a column of the solution in a capillary tube. Comparison is made with existing data on sea water at the lower frequencies. The results are examined in relation to the Debye-Falkenhagen electrolyte theory and to the theory of anomalous dispersion in dipolar liquids, and it is shown that the ionic and dipolar conductivities can be added arithmetically.

621.315.611.011.5 **1881**

Dependence of the Dielectric Constant of Barium Titanate upon the Pressure.—B. M. Wul & L. F. Vereshchagin. (*C. R. Acad. Sci. U.R.S.S.*, 30th Sept. 1945, Vol. 48, No. 9, pp. 634–636. In English.) A brief description of the apparatus used to measure the pressure variation is given. It was found that over the range of 300–2 000 atmospheres, the dielectric constant increased at a steadily diminishing rate. The work is being extended to include higher pressures and different temperatures.

621.315.615.017.143 **1882**

The Effect of High-Frequency Alternating Currents on Liquid Semiconductors.—J. Granier & G. Granier. (*C. R. Acad. Sci., Paris*, 16th April 1945, Vol. 220, No. 16, pp. 555–557.) Figures for resistivity (ρ) and loss angle (α) are given for hexane, ether, and vaseline oil at frequencies of 0, 10^3, 10^4, 10^5 and 10^6 c/s.

621.315.617.3 : 519.283 **1883**

Quality Control of Insulating Varnishes.—L. P. Hart, Jr. (*Gen. elect. Rev.*, April 1946, Vol. 49, No. 4, pp. 8–15.) The need for systematic checking of the composition and physical properties of the varnishes is pointed out, and a routine proved to be satisfactory in practice is described.

621.315.618.011.5 **1884**

The Dielectric Constants of Eight Gases.—L. G. Hector & D. L. Woernley. (*Phys. Rev.*, 1st/15th Feb. 1946, Vol. 69, Nos. 3/4, pp. 101–105.) The constants for He, Ne, A, H_2, O_2, N_2, CO_2 and dry air at STP have been measured to a few parts in 10^7 by a heterodyne method of observing the change in frequency of a tuned circuit on introducing the gas to a previously evacuated capacitor. The results are discussed in relation to previous work.

621.316.86 : 546.281.26 **1885**

[Silicon-carbide] **Non-Ohmic Resistors.**—F. Ashworth, W. Needham & R. W. Sillars. (*Electrician*, 29th March 1946, Vol. 136, No. 3539, pp. 817–818.) Summary and discussion of an I.E.E. paper.

621.319.51 : 546.78 **1886**

Electrical Properties of Tungsten Oxide Films.—F. L. Jones. (*Nature, Lond.*, 23rd March 1946, Vol. 157, No. 3986, pp. 371–372.) Letter briefly describing experiments on the intensity of cold-cathode electronic emission from tungsten electrodes on which were formed films of tungsten oxides, carried out with a view to devising a self-triggering two-electrode spark gap. The electrodes were used in a short spark gap with an applied impulsive electric field, the p.d. across the gap at breakdown being taken as a measure of the concentration of the initial electrons. Properties of rough and oxidized surfaces of tungsten were investigated with gaps in air and nitrogen at atmospheric pressure. Considerable emission was indicated for a surface coating of a mixture of the yellow and blue oxides of tungsten, and a polarity effect was observed when one of the electrodes was smooth clean tungsten. Roughened electrodes show emission without polarization. It is suggested that, in the case of oxide films, emission of electrons is due to intense microscopic electric fields set up by positive charges on the upper surface of the film, while with roughened electrodes photo-ionization takes place throughout the gap due to photons emitted from minute discharges at the microscopic points on the electrode. Normally the oxide surfaces show some degree of roughness and both causes probably operate.

621.396.69 **1887**

Printed Electronic Circuits.—C. Brunetti & A. S. Khouri. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 104–108.) Details of a technique for preparing compact radio apparatus. The "chassis" is a block of ceramic material such as steatite, upon which the circuit is built in the following stages :—(*a*) The wiring, consisting of silver in the form of a paint or paste, is applied to the base through a silk or metal stencil, and subsequently bonded by heat treatment. (*b*) Resistors in the form of a carbon or resin mixture are sprayed through masks in the appropriate positions in the circuit. (*c*) Small disk-type ceramic capacitors, and (*d*) any other components such as valves, are soldered directly to the silver wiring, using a 2% silver solder. Performance of these printed circuits and component stability are similar to those of ordinary equipment.

621.791.75 : 621.362 **1888**

Welding Fine Thermocouple Wires.—E. D. Hart & W. H. Elkin. (*J. sci. Instrum.*, Jan. 1946, Vol. 23, No. 1, pp. 17–18.) Simple method for wires of size 40–50 s.w.g.

621.791.76 : 546.621 **1889**

The Development of the Spot-Welding of Aluminium.—A. von Zeerleder. (*Schweiz. Arch. angew. Wiss. Tech.*, July 1944, Vol. 10, No. 7, pp. 218–226. Discussion, Nov. 1944, Vol. 10, No. 11, pp. 358..362. In German.) A brief historical survey and very detailed metallurgical study of present practice, with a bibliography of about 25 items. The discussion is mainly on the mitigation of the effects of spot-welding machines on the supply network.

621.791.76 : 621.3.011.2 **1890**

Measurement and Effect of Contact Resistance in Spot Welding.—R. A. Wyant. (*Trans. Amer. Inst. elect. Engrs*, Jan. 1946, Vol. 65, No. 1, pp. 26–33.) Static measurements using bridge circuits and dynamic measurements using oscillograph records were made on aluminium, magnesium and nickel alloys, and steel, with surfaces chemically and mechanically cleaned. Results are shown graphically, and remaining research problems are reviewed.

666.189.4 : 621.385 **1891**

Sintered Glass.—E. G. Dorgelo. (*Philips tech. Rev.*, Jan. 1946, Vol. 8, No. 1, pp. 2–7.) The technique is particularly useful in the construction of lamps and tubes for experimental purposes. The main features and applications are described.

679.5 **1892**

Plastics for the Amateur : Part 2.—A. G. Chambers. (*R.S.G.B. Bull.*, Jan. 1946, Vol. 21, No. 7, pp. 106–107.) A practical article describing recommended methods of working plastic materials with particular reference to the thermo-setting (Bakelite, Paxolin, Tufnol) and thermo-plastic (Perspex, Distrene, Alkathene) groups. For part 1 see 956 of April.

679.5 **1893**

Plastics and Chemicals.—(*Gen. elect. Rev.*, Jan. 1946, Vol. 49, No. 1, pp. 60–61.) Annual review of developments.

549.211 : 62 **1894**

Diamond Tools. [Book Review]—P. Grodzinski. N. A. G. Press, London, 1945, 20s. (*Engineering, Lond.*, 30th Nov. 1945, Vol. 160, No. 4168, p. 441.) Applications of diamonds described include hardness testing, crystal cutting, jewel bearings. "An invaluable work of reference for all who make use of diamonds in production."

621.315.6(083.75) **1895**

A.S.T.M. Standards on Electrical Insulating Materials (With related Information). [Book Review]—A.S.T.M. Committee D-9. American Society for Testing Materials, Philadelphia, 1945, 545 pp., $3.25. (*Proc. Inst. Radio Engrs, N.Y.*, Part II, April 1946, Vol. 34, No. 4, p. 210.) "This book contains all of the essential data which normally would be of interest to engineers engaged in the design or testing of electrical insulating materials and is presented in clear and easily readable form." See also 1274 of May.

679.5 : 621.3 **1896**

Plastics for Electrical and Radio Engineers. [Book Review]—Tucker & Roberts. Technical Press, Kingston, Surrey, 1946, 12s. (*Electrician*, 19th April 1946, Vol. 136, No. 3542, p. 1037.) ". . . explains sufficient about the manufacture and properties . . . and describes their methods of application . . ."

778 : 62 **1897**

Photography in Engineering. [Book Review]—C. H. S. Tupholme. Faber & Faber, London, 1945, 276 pp., 188 plates, 42s. (*Engineering, Lond.*, 30th Nov. 1945, Vol. 160, No. 4168, pp. 440–441. *Nature, Lond.*, 12th Jan. 1946, Vol. 157, No. 3976, pp. 32–33.) ". . . forms a greatly needed and compact source of information on the subject." Applications of photography to workshop and drawing-office practice are included.

MATHEMATICS

512.831 : 621.3.012.8 **1898**

Tensors and Equivalent Circuits.—B. Hoffmann. (*J. Math. Phys.*, Feb. 1946, Vol. 25, No. 1, pp. 21–25.) Criticism of Kron's work on equivalent circuits (2905 of 1943 and 2838 of 1944) for mechanical, electrodynamical, and other systems.

517.3 **1899**

An Extension of Schuster's Integral.—H. Bateman. (*Proc. nat. Acad. Sci., Wash.*, March 1946, Vol. 32, No. 3, pp. 70–72.) The integral occurs in the theory of total reflection of light.

517.564.3 **1900**

A Note on Bessel Functions of Purely Imaginary Argument.—E. W. Montroll. (*J. Math. Phys.*, Feb. 1946, Vol. 25, No. 1, pp. 37–48.)

517.947.44 **1901**

On the Near-Periodicity of Solutions of the Wave Equation : Part 1.—S. L. Soboleff. (*C.R. Acad. Sci. U.R.S.S.*, 20th Sept. 1945, Vol. 48, No. 8, pp. 542–545. In French.) Mathematical analysis of the wave equation for the general case of a space of n variables leading to the conclusion that subject to the continuity of certain derivatives of the solution to the wave equation, the latter can be shown to be periodic or nearly periodic.

517.947.44 **1902**

On the Near Periodicity of Solutions of the Wave Equation : Part 2.—S. L. Soboleff. (*C.R. Acad. Sci. U.R.S.S.*, 30th Sept. 1945, Vol. 48, No. 9, pp. 618–620. In French.) "In an earlier note [see 1901 above] it was shown that the solutions of the wave equation with constant coefficients were nearly periodic. . . . In the present note a generalization of the earlier results for the case of a wave equation with variable coefficients is given."

518.5 **1903**

A Computer for Solving Linear Simultaneous Equations.—Berry, Wilcox, Rock & Washburn. (*See* 1927.)

518.5 **1904**

Integrating Machine for Ordinary Differential Equations.—R. Sauer & H. Pösch. (*Z. Ver. dtsch. Ing.*, 17th April 1943, Vol. 87, Nos. 15/16, pp. 221–224.) Brief description of the design and testing of a mechanical integrator.

518.5 : 621.38 **1905**

[U.S.] **War Department unveils 18 000-Tube Robot Calculator.**—U.S. Army Ordnance Dept. (*See* 1928.)

534.26 **1906**

On Diffraction of Elastic Waves.—D. I. Scherman. (*C. R. Acad. Sci. U.R.S.S.*, 30th Sept. 1945, Vol. 48, No. 9, pp. 626–629. In English.) A short mathematical paper on the calculation of the vector components of a steady vibration propagated in an elastic medium.

621–526 **1907**

On the Method of van der Pol and its Application to Non-Linear Control Problems [servo mechanisms]. —B. V. Bulgakov. (*J. Franklin Inst.*, Jan. 1946, Vol. 241, No. 1, pp. 31–54.) "The construction of approximate differential equations of a mechanical or electrical pseudo-linear oscillatory system with many degrees of freedom. . . . applicable to the study of the transitory or quasi-periodic processes and not only of the periodic vibrations" as previously investigated.

The analysis is applied to an automatically controlled system with inertia (a servo mechanism) in which feedbacks proportional to the departure from the preselected state and the first and second time derivatives of this quantity are present. It is shown that in the absence of continuous external perturbations the effect of the acceleration control is equivalent to the alteration of the constants in a system without such control.

Periodic vibrations of the system are studied by an "approximate linearization" of the equation expressing the behaviour of the servo motor, and the conditions for stability are investigated.

621.395.4 **1908**

The Probability Distributions of Sinusoidal Oscillations Combined in Random Phase.—M. Slack. (*J. Instn elect. Engrs*, Part III, March 1946, Vol. 93, No. 22, pp. 76–86.) A theoretical discussion of "the probabilities associated with the instantaneous value and the length of the resultant vector obtained by combining n cosine oscillations of equal amplitude and random phase relationship. It is mainly concerned with very small values of n ($= 2, 3, 4, \ldots 12$), and gives, for the first time, a complete set of curves showing the probabilities of the instantaneous value and the length of the resultant vector exceeding any given limits." The problem is fundamental to multichannel transmission through a common amplifier, the operational loading of which depends on whether there can be simultaneous occurrence of peak values in all the speech channels.

538.566 : 621.396.677.029.64 **1909**

Laguerre Functions in the Mathematical Foundations of the Electromagnetic Theory of the Paraboloidal Reflector.—E. Pinney. (*J. Math. Phys.*, Feb. 1946, Vol. 25, No. 1, pp. 49–79.) The laws of geometrical optics are not rigorously applicable for microwave radiation within a paraboloidal reflector; differences from experimental results are considerable, even for reflector diameters as great as 10–15 wavelengths. The paper establishes "a beginning point for this practical development of a more rigorous paraboloidal theory". Extensive bibliographies are given for the polynominals $L_n(z)$ and $L^a{}_n(z)$.

MEASUREMENTS AND TEST GEAR

621.3.011.2 : 546.87 **1910**

Negative Resistance-Temperature Coefficient of Thin Evaporated Films of Bismuth.—Tulley. (*See* 1878.)

621.317 **1911**

A.I.E.E. Winter Convention January 1946.—(*Elect. Engng, N.Y.*, Jan. 1946, Vol. 65, No. 1, pp. 29 . . 35.) Abstracts are given of the following papers presented at the convention :—Electronically Balanced [Potentiometer-] Recorder for Flight Testing and Spectroscopy, by A. J. Williams, Jr., W. R. Clark & R. E. Tarpley. Techniques and Facilities for Microwave Radar Testing, by E. I. Green, H. J. Fisher & J. G. Ferguson. Titles of other papers are given in other sections. For other abstracts, see *Electronics*, April 1946, Vol. 19, No. 4, pp. 230 . . 266.

621.317 **1912**

A Braille Analyzer.—W. S. Wartenberg. (*Radio Craft*, March 1946, Vol. 17, No. 6, pp. 387–388.) An instrument for use by the blind for measuring direct current, p.d., and impedance. The unknown quantity is balanced against a standard, essentially by the use of potentiometer circuits. The out-of-balance current is passed through earphones, and is interrupted by a vibrator switch so as to produce an audible note that vanishes in amplitude when balance is reached. The potentiometer control and circuit switches have Braille markings.

621.317.3.029.58/.62] : 621.315.213.12 **1913**

Apparatus for Measurements on Balanced-Pair High-Frequency Cables in the Range 10-200 Mc/s.—J. C. Simmonds. (*J. Instn elect. Engrs*, Part I, March 1946, Vol. 93, No. 63, pp. 148–149.) Summary of 667 of March.

621.317.3.029.63/.64 **1914**

Radio Measurements in the Decimetre and Centimetre Wavebands.—R. J. Clayton, J. E. Houldin, H. R. L. Lamont & W. E. Willshaw. (*J. Instn elect. Engrs*, Part III, March 1946, Vol. 93, No. 22, pp. 97–117. Discussion, pp. 117–125.) A survey of apparatus and methods used in the research laboratory of the (British) General Electric Co. A large number of subjects are briefly discussed under the headings of circuit theory, signal sources, the measurement of frequency, power, impedance, and field strength, and measurements on receivers and aerials. The paper is followed by a long discussion.

621.317.3.029.63/.64] : 621.315.611 **1915**

Resonance Methods of Dielectric Measurement at Centimetre Wavelengths.—F. Horner, J. A. Taylor, R. Dunsmuir, J. Lamb & W. Jackson. (*J. Instn elect. Engrs*, Part I, March 1946, Vol. 93, No. 63, pp. 149–150.) Summary of 966 of April.

621.317.33.029.63 **1916**

The Measurement of Impedances particularly on Decimetre Waves.—J. M. van Hofweegen. (*Philips tech. Rev.*, Jan. 1946, Vol. 8, No. 1, pp. 16–24.) At wavelengths greater than 1 m, the detuning and damping of a tuned circuit by the impedance is measured, using a diode voltmeter. At shorter wavelengths, *e.g.* 50 cm, a screened twofold Lecher system is used.

621.317.35 **1917**

Complex Waveforms : The Harmonic Synthesiser.—H. Moss. (*Electronic Engng*, April 1946, Vol. 18, No. 218, pp. 113–116.) Part 4 of a series on c.r.t. traces. Three types of wave symmetry (alternance, normal and skew symmetry) are illustrated, and their application to wave form analysis discussed. For part 3 see 3988 of 1945.

621.317.361+621.396.611.21 **1918**

Low-Frequency Quartz Crystals.—C. E. Lane. (*Radio, N.Y.*, March 1946, Vol. 30, No. 3, pp. 12, 14.) Illustrated summary of 1582 of June.

621.317.7 : 621.319.4 **1919**

Capacitors for Measurement.—C. G. Garton. (*Electrician*, 1st March 1946, Vol. 136, No. 3535, pp. 543–544.) An account of the reading and discussion of an I.E.E. paper on the characteristics and errors of capacitors used for measurement purposes.

621.317.7 : 621.396.62 **1920**

Sensitive [Signal-] **Tracer.**—C. Zwicker. (*Radio Craft*, March 1946, Vol. 17, No. 6, pp. 393–394.) Description and circuit diagram of a tracer for use in servicing receivers.

621.317.7 : 621.396.82 : 551.57 :629.135 **1921**

[U.S.] **Army-Navy Precipitation-Static Project : Part 2—Aircraft Instrumentation for Precipitation-Static Research.**—Waddel, Drutowski & Blatt. (*See* 1992.)

621.317.725 : 621.385 **1922**

Converting D.C. [volt] **Meter to A.C. V.T.V. Use.**—W. M. Breazeale. (*Communications*, March 1946, Vol. 26, No. 3, pp. 38–39.) A circuit comprising a triode cathode follower that rectifies the signal, and a pentode cathode follower that operates the d.c. meter. Diode overload protection is included.

621.317.761.029.62/.64 **1923**

The Measurement of Frequencies in the Range 100 Mc/s to 10 000 Mc/s.—L. Essen & A. C. Gordon-Smith. (*J. Instn elect. Engrs*, Part I, March 1946, Vol. 93, No. 63, p. 147.) Summary of 679 of March.

621.317.763.029.62/.64] : 621.396.611 **1924**

Cavity-Resonator Wavemeters.—L. Essen. (*Wireless Engr*, May 1946, Vol. 23, No. 272, pp. 126–132.) A detailed description of " four simply constructed cavity-resonator wavemeters covering the frequency ranges 10 000 Mc/s–4 000 Mc/s, 5 600 Mc/s–2 000 Mc/s, 2 700 Mc/s–1 000 Mc/s and 1 000 Mc/s–200 Mc/s. The mode of resonance employed is the hybrid between the cylindrical TM_{010} mode and the coaxial TM_{00p} mode, and the frequency variation is effected by the axial movement of a plunger attached to a micrometer head. For the first three wavemeters the plunger is of a non-contact design, thus obviating the necessity for a good electrical contact which has hitherto caused considerable manufacturing difficulties. The setting accuracy of the instruments is shown to be better than 1 part in 10^4 of frequency throughout the greater part of the range."

621.317.79 : 621.39 **1925**

New Test Equipment Circuits.—(*Radio, N.Y.*, March 1946, Vol. 30, No. 3, p. 30.) Circuit diagrams of an intermodulation analyser and a dual RC sine-wave signal generator.

621.396.611.21 : 621.396.615.14 **1926**

Frequency Stabilization at 450 Mc/s.—P. B. Myers. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 214..216.) Generator using the fifth harmonic of a 10-Mc/s crystal with two electronic triplers. The output at 450 Mc/s is as stable (2.5 parts in 10^6) as the crystal's fundamental frequency.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

518.5 **1927**

A Computer for Solving Linear Simultaneous Equations.—C. E. Berry, D. E. Wilcox, S. M. Rock & H. W. Washburn. (*J. appl. Phys.*, April 1946, Vol. 17, No. 4, pp. 262–272.) Basic electrical circuits for representing the mathematical relations are given, and a commercial model of a 12-equation computor described. This may be applied to any problem involving simultaneous linear equations, and it is found that solving 12 equations requires only 1/4 to 1/7 of the time required by conventional methods.

518.5 : 621.38 **1928**
[U.S.] **War Department unveils 18 000-Tube Robot Calculator.**—U.S. Army Ordnance Dept. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 308..314.) Description of the Electronic Numerical Integrator and Computer (Eniac) designed for aiding ordnance calculations. It is a digital machine, performs a single addition in 1/5 000 sec, and can carry out more than 10^7 additions or subtractions of ten-figure numbers in 5 minutes. The arithmetic, memory, and control elements are described, and the use of punched cards for external memory is noted.

53 + 6](73) **1929**
American Trends of Development in the Physical Sciences.—Overbeck. (*See* 2073.)

621.3 : 629.13 **1930**
Air Forces' Needs in Electric Equipment.—G. C. Crom, Jr. (*Elect. Engng, N.Y.*, Jan. 1946, Vol. 65, No. 1, pp. 17–22.) The substance of a lecture reviewing control, communications, and navigation.

621.317.39 **1931**
Electrical Non-Destructive Testing of Materials.—G. R. Polgreen & G. M. Tomlin. (*Electronic Engng*, April 1946, Vol. 18, No. 218, pp. 100–105.) The correct correlation between the electrical and magnetic properties of the materials and the corresponding physical properties, which the instruments are required to measure, is dealt with in general. Details are given of a magnetic sorting bridge for testing the chemical composition, hardness and tempering of springs, valves, and gudgeon pins for internal combustion engines. Also described are an r.f. method for detecting and measuring longitudinal cracks, laps, or seams in uniform-cross-section conductors of any length, and diameters ranging from 1/8 inch to 6 inch, the Tait layer-thickness meter for measuring non-magnetic coatings on a magnetic base, and an electronic micrometer for the continuous measurement of metal foil thickness.

621.318.572 : 778 **1932**
Spectrograph Exposure Control.—J. R. Cosby. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 123–125.) A semi-automatic device for obtaining duplicate exposures of spectrographic plates despite variation of source intensity. The current through a photocell exposed to the light source charges the grid of a cold-cathode tube which ultimately fires, operates a ratchet counter, and re-establishes its initial operating condition. The exposure is ended after a predetermined number of impulses.

621.365.5 + 621.317.39 **1933**
A.I.E.E. Winter Convention January 1946.—(*Elect. Engng, N.Y.*, Jan. 1946, Vol. 65, No. 1, pp. 29..35.) Abstracts are given of the following papers presented at the convention :—Induction Heating of Long Cylindrical Charges, by H. F. Storm. Stress Measurement by Electrical Means, by S. B. Williams & R. E. Kern. Titles of other papers are given in other sections.

For other abstracts see *Electronics*, April 1946, Vol. 19, No. 4, pp. 230..266.

621.365[.5 + .92 **1934**
Role of Automatic Rematching in H.F. Heating.—E. Mittelman. (*Elect. World, N.Y.*, 4th Aug. 1945, p. 98.) Abstract in *Electronic Engng*, May 1946, Vol. 18, No. 219, p. 155.

621.365[.5 + .92 **1935**
High-Frequency Electric Heating.—(*Electrician*, 8th Feb. 1946, Vol. 136, No. 3532, pp. 351–354.) A number of industrial applications are discussed.

621.365.5 + 621.365.92] : 621.396.662 **1936**
A.F.C. for R.F. Heating.—S. I. Rambo. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 120–122.) The changing load during a heat cycle makes some form of frequency control essential to avoid interference with communication services. Crystal oscillators with power amplifiers may be suitable for low powers. Mechanical variation of the tuning circuit is cheaper and simpler for powers over about 10 kW. A practical system using a reversible motor is outlined, and a method of regaining control when the frequency is outside the bandwidth of the discriminator is described.

621.365.52 **1937**
Steel Furnaces : Coreless Induction Type.—M. J. Marchbanks. (*Elect. Rev., Lond.*, 19th & 26th April 1946, Vol. 138, Nos. 3569 & 3570, pp. 603 & 641.) Summary and discussion of an I.E.E. paper.

621.365.52 **1938**
H.F. Inductor Heating.—(*Elect. Rev. Lond.*, 15th March 1946, Vol. 138, No. 3564, pp. 399–403.) Special attention is given to cases where only part of the object requires heat treatment. The equipment described (Birlec Ltd.) includes a spark-gap type for uncritical operations, frequency up to 100 kc/s, and h.f. alternator, frequency up to 12 kc/s for heating more than 200 lb of metal per hour, and a valve generator, frequency above 12 kc/s, for heating less than 200 lb per hour.

621.365.92 : 664.6 **1939**
R.F. Heating in Bakery Industry.—V. W. Sherman. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 166..186.) A survey of applications and costs. Report of lecture.

621.38 + 621.395/.396] (43) : 06.064 **1940**
Exhibition of German Electronic Equipment.—P. I. Nicholson. (*Electronic Engng*, May 1946, Vol. 18, No. 219, pp. 156–157.) An account of the exhibition at Earls Court, which included radio components, valves, relays, communications equipment, acoustic instruments, infra-red equipment, radio navigational aids and control units for rockets and other missiles.

621.38 + 621.396 **1941**
Electronics.—(*Gen. elect. Rev.*, Jan. 1946, Vol. 49, No. 1, pp. 54–58.) Annual review of developments.

621.38 : 62 **1942**
Electronics in Engineering.—(*Engineer, Lond.*, 25th Jan. 1946, Vol. 181, No. 4698, pp. 82–83.) Description of some instruments designed by the (British) General Electric Co., including magnetic sorting bridge, r.f. crack detector, film thickness meter, and metal thickness meter.

621.383 : 551.576 **1943**
The Cloud Range Meter.—F. J. Moles. (*Gen. elect. Rev.*, Apr. 1946, Vol. 49, No. 4, pp. 46–48.) An optical device analogous with radar. Very

intense light flashes of one microsecond duration are produced by a high-voltage spark gap at the focus of a paraboloidal reflector. The beam is aimed at the cloud and the flashes are reflected back to a receiving paraboloidal mirror with a photocell at its focus. Both mirrors are mounted on the same support, point in the same direction, and move together. The pulses from the photocell are amplified in a high-gain video amplifier and displayed on a c.r. oscillograph. The timebase sweep is started in synchronism with the transmitted pulse, so the position of the reflected pulse along the sweep is a measure of the cloud distance ; a calibrated scale on the mirror support gives the cloud elevation. The whole apparatus is compact and transportable.

621.385.833 **1944**

The Measured Characteristics of Some Electrostatic Electron Lenses — Discussion.—K. Spangenberg. (*Elect. Comm.*, 1945, Vol. 22, No. 4, pp. 379–380.) Discussion of 1294 of 1944 (Spangenberg & Field) explaining an apparent discrepancy, and correcting a typographical error.

621.385.833 **1945**

Calculation of Fields of the Simplest Electrostatic Lenses.—A. Vlasov. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 60.) Abstract of a paper of the Acad. Sci., U.S.S.R.

621.385.833 **1946**

A Short Magnetic Lens with a Minimum Spherical Aberration.—A. Vlasov. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 60.) Abstract of a paper of the Acad. Sci., U.S.S.R.

621.385.833 **1947**

Further Improvement in the Resolving Power of the Electron Microscope.—J. Hillier. (*J. appl. Phys.*, April 1946, Vol. 17, No. 4, pp. 307–309.)

621.385.833 **1948**

Electron Microscope of the State Optical Institute.—V. Vertzner. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 60.) The instrument gives a magnification up to 25 000 with a resolving power of 75–100 Å, providing two microphotographs per charge of the camera. In an investigation of the evaporation of silver on a celluloid film, particle dimensions of 75–300 Å with separations of 200 Å were noted, corresponding to 13 $\mu g/cm^2$. Abstract of a paper of the Acad. Sci., U.S.S.R.

621.385.833 **1949**

A Shadow-Casting Adaptor for the Electron Microscope.—T. F. Anderson. (*Rev. sci. Instrum.*, Feb. 1946, Vol. 17, No. 2, pp. 71–72.)

621.385.833 **1950**

Preparation of Electron Microscope Specimens for Determination of Particle Size Distribution in Aqueous Suspensions.—A. M. Cravath, A. E. Smith, J. R. Vinograd & J. N. Wilson. (*J. appl. Phys.*, April 1946, Vol. 17, No. 4, pp. 309–310.)

621.385.833 **1951**

Electron Microscope and Investigation of the Structure of Ceramic Materials.—I. I. Kitaigorodsky. (*C. R. Acad. Sci. U.R.S.S.*, 20th Sept. 1945, Vol. 48, No. 8, pp. 563–564. In English.)

621.385.833 : 537.533 **1952**

Field-Emission of Electrons.—P. Lukirsky. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, pp. 59–60.) The field-emission current from a metal usually takes place at lower fields than is required by the Fowler-Nordheim theory because of surface roughness. With smooth spheres, theoretical values of the current agree with experiment. Complex cathodes were investigated and current resulted at field strengths of 10^6 V/cm. The energy spectrum of the emitted electrons and field emission from single crystals was examined in relation to the field-emission electron microscope. Abstract of a paper of the Acad. Sci., U.S.S.R.

621.386.1 : 6 **1953**

Prague Conference on the Use of X-Rays in the Metal Industries.—V. Vand. (*Nature, Lond.*, 30th March 1946, Vol. 157, No. 3987, pp. 415–416.)

621.396.9 : 529.781 **1954**

Pocket Radio Watch.—E. A. Witten. (*Radio Craft*, March 1946, Vol. 17, No. 6, p. 389.) Non-technical description of proposed broadcast time-signal service that would operate with pocket receivers.

621.396.91 : 550.37 **1955**

Radio-Sonde Recording of Potential Gradients.—K. Kreielsheimer & R. Belin. (*Nature, Lond.*, 23rd Feb. 1946, Vol. 157, No. 3982, pp. 227–228.) The modulation frequency of the balloon transmitter is varied by changes in the modulator grid potential caused by passing the current due to a point discharge through a resistor. The discharge is initiated by a field of 3 V/cm with a 64-ft collector wire. A sample record of a balloon flight through an isolated CuNb cloud is shown.

621.396.933.2 : 621.396.91 **1956**

The Application of Ultra-Short-Wave Direction Finding to Radio Sounding Balloons.—Smith-Rose & Hopkins. (*See* 1864.)

621.398 + 621.396.932 **1957**

The Engineering Work of the Clyde Lighthouses Trust.—Stevenson. (*See* 1862.)

621.3.078 : 54 **1958**

Principles of Industrial Process Control. [Book Review]—D. P. Eckman. J. Wiley & Sons, New York, 1945, 237 pp., $3.50. (*J. sci. Instrum.*, Jan. 1946, Vol. 23, No. 1, p. 18. *Electronic Industr.*, Feb. 1946, Vol. 5, No. 2, pp. 161–162.) " . . . deals essentially with the design and operation of controllers and control instruments which are used in the chemical industry."

621.365.92 **1959**

Capacity Current Heating. [Book Review]—T. H. Messenger & D. V. Onslow. British Electrical & Allied Industries Research Assn., London, 1945, 9s. (*Engineering, Lond.*, 7th Dec. 1945, Vol. 160, No. 4169, p. 474.) Summarizes available information on existing applications. The report is in three sections dealing with theory, applications, and equipment costs, and contains a bibliography of 241 items.

621.388.833 **1960**

Electron Optics and the Electron Microscope. [Book Review]—V. K. Zworykin, G. A. Morton, E. G. Ramberg, J. Hillier & W. A. Vance. John Wiley & Sons, New York, 754 pp., $10.00. (*Proc. Inst. Radio Engrs, N.Y.*, Part II, April 1946, Vol. 34, No. 4, p. 212.)

PROPAGATION OF WAVES

621.396.11 + 621.396.67 **1961**

The Ratio between the Horizontal and the Vertical Electric Field of a Vertical Antenna of Infinitesimal Length Situated above a Plane Earth.—Niessen. (*See* 1769.)

621.396.11 **1962**

On the Propagation of Radio Waves along an Imperfect Surface : Part 3.—E. Feinberg. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, pp. 1–6.) This part deals with the effective path of the ground ray. It is suggested that the earth regions immediately surrounding the transmitter and receiver are of much greater importance than the rest of the intervening path. The analysis is based on Sommerfeld's theory, but has limited application as it applies only for large numerical distances where the integrals involved may be approximated by asymptotic formulae. The parameters characterizing an imperfect intermediate region of the path are negligible only in so far as the assumed perfect initial and final regions have the dimensions for which the numerical distances, calculated with respect to the properties of the intermediate region, are large compared to unity. For previous work see 2529/2531 of 1945.

621.396.11 : 061.6 **1963**

Interservice Radio Propagation Laboratory.—(*J. Franklin Inst.*, Jan. 1946, Vol. 241, No. 1, pp. 62–63.) An account of the laboratory set up at the National Bureau of Standards during the war to supply radio propagation information to the Armed Forces.

621.396.11 : 551.51.053.5 **1964**

Forecasting for Radio.—M. G. Morrow. (*Sci. News Lett., Wash.*, 13th Apr. 1946, Vol. 49, No. 15, pp. 234–235.) Simple account of the predictions based on ionospheric and solar observations.

621.396.11 : 551.51.053.5 **1965**

Short-Wave Conditions.—T. W. Bennington. (*Wireless World*, April 1946, Vol. 52, No. 4, p. 124.) Propagation conditions are forecast for April 1946, with tables of maximum usable frequencies. Conditions occurring in February are described, including the effect of a large sunspot group.

621.396.11 : 551.51.053.5 **1966**

Low-Level Reflections Observed at Christmas Island.—Peavey. (*See* 1841.)

621.396.11 : 551.51.053.5 **1967**

Intense Scatter in E_s-Region at Christmas Island.—Peavey. (*See* 1840.)

621.396.11 : 551.53.051.5 **1968**

Short Period Fluctuations in the Characteristics of Wireless Echoes from the Ionosphere.—T. L. Eckersley & F. T. Farmer. (*Proc. roy. Soc. A*, 21st Aug. 1945, Vol. 184, No. 997, pp. 196–217.) A spaced-frame direction-finder system is used with a twin-channel amplifier and c.r.t. display. The phases and amplitudes of the e.m.f.s in the aerial system can be determined from the elliptical trace, by using appropriate aerial connexions. Pulse transmissions can be examined by means of an adjustable gating device that desensitizes the receiver for all but about 15 μs of the timebase cycle. Rapid changes in polarization and direction can be studied.

F-layer echoes show little change in characteristics over a period of about 20 seconds, abnormal-*E* and scatter reflections change in one second or less, but a continuity of phase was noticed even during the most rapid changes. The scatter echoes show remarkable variability of phase and direction. Skellett's suggestion (1752 of 1938) of meteoric origin of these echoes seems unlikely, as meteoric velocities of 100 km/s would be required.

621.396.11 : 523.76 : 551.51.053.5 **1969**

The Solar Eclipse of 1945 and Radio Wave Propagation.—Smith-Rose. (*See* 1831.)

621.396.11.029.56/.58 **1970**

The NBS-ARRL Radio Observing Projects.—T. N. Gautier, Jr. (*QST*, Apr. 1946, Vol. 30, No. 4, pp. 18–23.) Since 1941, members of American Radio Relay League observed signal strengths and the highest frequencies received in the band 1.5–30 Mc/s. In 1943 similar observations were started using transmitter WWV (2.5, 5, 10 and 15 Mc/s). Charts show how the observations agreed with the maximum usable frequencies and the lowest useful high frequencies forecast by the National Bureau of Standards. See also *J. Franklin Inst.*, March 1946, Vol. 241, No. 3, pp. 243–244.

621.396.11.029.64+621.396.24+621.385.1 **1971**

Simultaneous Use of Centimeter Waves and Frequency Modulation.—A. G. Clavier & V. Altovsky. (*Elect. Comm.*, 1945, Vol. 22, No. 4, pp. 326–338.) English translation of 402 of February.

621.396.11.029.64 : 551.577 **1972**

The Effect of Rain upon the Propagation of Waves in the 1- and 3-Centimeter Regions.—S. D. Robertson & A. P. King. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, April 1946, Vol. 34, No. 4, pp. 178–180.) Observations were made on wavelengths of 1.09 cm and 3.2 cm over sufficiently short paths (1260 ft and 900 ft) to obtain uniformity of rainfall. There was a definite correspondence between heaviness of rainfall and attenuation of the radio signal on both wavelengths, the effect being greater on the shorter wavelength. Results were obtained mainly from two heavy storms, and mean values deduced from them were 0.05 db/mile path loss per mm/hr rainfall for $\lambda = 3.2$ cm and 0.3 db/mile per mm/hr for $\lambda = 1.09$ cm. During extremely heavy rain the attenuation was roughly 5 and 30 db/mile respectively for the two wavelengths.

621.396.11.029.64 : 551.577 **1973**

Propagation of 6-Millimeter Waves.—G. E. Mueller. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, April 1946, Vol. 34, No. 4, pp. 181–183.) Observations on the effect of rainfall on waves of length 0.62 cm were made over a 1200-ft path. The method used was similar to that of Robertson & King (see 1972 above) and gave a mean value of 0.6 db/mile attenuation per mm/hr rainfall. The nonlinearity of the attenuation/wavelength curve found in a comparison with the results of Robertson & King is explained qualitatively in terms of the relative influence of scattering and absorption by the drops. Atmospheric absorption was found to be small (perhaps 0.2 db/mile) compared with loss due to rain.

RECEPTION

621.396.1 **1974**

CAA Alaskan Diversity Receiving System : Part 2.—Ivers. (*See* 2002.)

621.396.11.029.64+621.396.24+621.385.1 **1975**

Simultaneous Use of Centimeter Waves and Frequency Modulation.—Clavier & Altovsky. (*See* 1971.)

621.396.61.029.62 **1976**

The "Tiny Tim" Handie-Talkie.—Haist. (*See* 2063.)

621.396.62+621.395.92 **1977**

Radio Hearing Aid.—Montani. (*See* 1763.)

621.396.62 **1978**

Radio Design Data presented in Chicago.—(*Electronics*, April 1946, Vol. 19, No. 4, pp. 216 . . 224.) Abstracts of papers on f.m. receiver design, trends in receiver response, and intermodulation effects in audio amplifiers presented at the Conference of the Chicago Section of the I.R.E.

621.396.621 **1979**

I.R.E. Winter Technical Meeting 1946.—(*Communications*, Feb. 1946, Vol. 26, No. 2, pp. 22 . . 66.) Abstracts of some of the papers read. For titles, see 1649 of June.

621.396.621 **1980**

Station Design and Planning : Parts 4 & 5. The Amateur Bands Receiver.—W. H. Allen. (*R.S.G.B. Bull.*, March 1946, Vol. 21, No. 9, pp. 138–141, April 1946, Vol. 21, No. 10, pp. 154–156.) A general account of the desirable features with elementary hints and suggestions for obtaining good performance, and notes on the design of a.f. stages. For previous parts see 1058 of April, 1801 and 2067.

621.396.621 **1981**

Super-Reflex Radio.—W. T. Connatser. (*Radio Craft*, March 1946, Vol. 17, No. 6, pp. 403 . . 424.) Description and circuit of a three-valve superheterodyne broadcast-receiver.

621.396.621 **1982**

Hi-Fi T.R.F. Tuner.—W. F. Frankart. (*Radio Craft*, March 1946, Vol. 17, No. 6, pp. 401, 415.) Circuit diagram and constructional details of a three-stage tuner for a.m. broadcast reception.

621.396.621 **1983**

Radio Data Sheet 333.—(*Radio Craft*, March 1946, Vol. 17, No. 6, p. 395.) Servicing data for (U.S.) General Electric receivers 100, 101, 103 and 105.

621.396.621 : 621.396.619.018.41 **1984**

F.M. Radio Service.—J. King. (*Radio Craft*, March 1946, Vol. 17, No. 6, pp. 391, 443–444.) Some instructions for servicing f.m. receivers, indicating the main differences between a.m. and f.m. receivers.

621.396.621.53 **1985**

Superheterodyne Frequency Conversion using Phase-Reversal Modulation.—E. W. Herold. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, April 1946, Vol. 34, No. 4, pp. 184–198.) "The principle of conversion herein described is to reverse the phase of the signal output periodically at a rate which differs from the signal frequency by the intermediate frequency. This may be done either by continuous variation of phase or by continuous variation of tube transconductance from positive to negative. The result is a conversion transconductance which is twice as high as had heretofore been believed ideal. Furthermore, if the phase-reversal rate is made by any integral multiple of an applied local-oscillator frequency, equally good conversion is obtained at a harmonic of the local oscillator without spurious responses at any other harmonic than the one chosen. An electron tube with a multi-humped characteristic has been devised as a means to this end since the transconductance characteristic will then vary from positive to negative as the control voltage is varied. An analysis of such a tube is carried out in detail, including the effect of fluctuation noise.

"The analysis shows that the new conversion method doubles the conversion gain possible in a tube with a given maximum transconductance. In an ideal case with no second-stage noise, the signal/noise ratio is as good as with the same tube used as amplifier ; even in practical cases, the mixer is only 10%–20% poorer than the amplifier. This is in contrast with conventional mixer methods in which the signal/noise ratio is from two to three times poorer than when the same tube is used as an amplifier.

"Conversion at a harmonic may also be achieved with high gain but it is found that the signal/noise ratio is not as favourable as with fundamental operation."

621.396.621.53 **1986**

Non-Linear Analysis.—H. Stockman. (*Radio, N.Y.*, March 1946, Vol. 30, No. 3, pp. 14, 47.) Illustrated summary of 1492 of June.

621.396.621.53.029.58 **1987**

A Band Pass 28-Mc/s Converter.—B. Goodman. (*QST*, Apr. 1946, Vol. 30, No. 4, pp. 44 . . 120.) The construction of a fixed-tune, two-stage amplifier using staggered, single-tuned, low-Q circuits to obtain a pass-band ± 1.25 Mc/s at 29 Mc/s. A triode oscillator and a pentode mixer convert the signal frequency to 7.3 ± 1.25 Mc/s. A conventional communication receiver follows the converter.

621.396.622.71 **1988**

A Low-Distortion Diode Detector.—R. Knowles. (*R.S.G.B. Bull.*, Jan. 1946, Vol. 21, No. 7, p. 108.) An arrangement of a double-diode-triode (HL41/DD) to provide an efficient detector free from peak-clipping. A capacitor connected in the cathode circuit ensures that the input conductance, and therefore the damping of the tuned circuit, is small.

621.396.622.71 **1989**

Low Distortion Diode Detector.—R. G. Kitchenn : F. A. Ruddle. (*R.S.G.B. Bull.*, April 1946, Vol. 21, No. 10, p. 161.) Correspondence on 1988 above.

621.396.82 **1990**

Beat-Frequency Interference Chart.—D. Barton. (*Electronics*, April 1946, Vol. 19, No. 4, p. 162.) Chart showing possible interfering signal frequencies when using a receiver with an i.f. of 445 kc/s, tuned within the range 550 to 1 600 kc/s. The curves are computed from formulae in 1879 of 1941 (Adams).

621.396.82 : 551.57 : 629.135 **1991**

[U.S.] **Army-Navy Precipitation-Static Project : Part 1—The Precipitation-Static Interference**

Problem and Methods for Its Investigation.—R. Gunn, W. C. Hall & G. D. Kinzer. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, April 1946, Vol. 34, No. 4, pp. 156–161.) The general nature of the project is reviewed, and the main lines of investigation discussed. One of the most important causes of precipitation static is the corona discharge which follows charging either by thunderstorms or by frictional electrification of the plane in flying through normal precipitation. Details of investigations on the various types of charging and discharging are given in ensuing papers. See 1992, 1993, and three other papers to be published later.

621.396.82 : 551.57 : 629.135 : 621.317.7 **1992**

[U.S.] **Army-Navy Precipitation-Static Project : Part 2—Aircraft Instrumentation for Precipitation-Static Research.**—R. C. Waddel, R. C. Drutowski & W. N. Blatt. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, April 1946, Vol. 34, No. 4, pp. 161–166.) Electric-field meters and wick dischargers measure the intensity and direction of the electric field, and an artificial charger simulates autogenous charging conditions. " A radio-noise meter is used to measure the interference level associated with precipitation static. Search electrodes, termed patches and probes, provide both integrated and detailed information on the charging processes concerned when precipitation strikes solid surfaces. An air-conductivity meter is provided for measuring the conductivity and ion content of the atmosphere. An accelerometer utilizing a telegauge tube measures turbulence. Data from the above and other instruments are brought to a central meter panel and intermittently photographed in flight. This photo-observer is supplemented by a disk voice recorder."

Some details are given of the various instruments used.

621.396.82 : 551.57 : 629.135 **1993**

[U.S.] **Army-Navy Precipitation-Static Project : Part 3—Electrification of Aircraft flying in Precipitation Areas.**—R. G. Stimmel, E. H. Rogers, F. E. Waterfall & R. Gunn. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, April 1946, Vol. 34, No. 4, pp. 167–177.) The main cause of electrification causing precipitation static is friction between the aircraft and particles of snow and ice. The charging characteristics of typical aircraft flying through dry snow are given and correlated with reliable data obtained on the ground under controlled conditions. It is shown that the charging depends both in rate and sign on the material of the surface of the aircraft. It was possible to make a non-charging aircraft by coating part of the surface with colloidal silica, so that the charging of the coated and uncoated parts balanced, but the contamination of the surface after ordinary servicing of the aircraft destroyed the non-charging property.

The charging current is a maximum at about −5 to −10°C under otherwise similar conditions. Under most conditions the charging current increases as the cube of the air speed.

Discharge first occurs by thermal ionization of the exhaust gases, and then, at higher voltage gradients (*e.g.* $\sim$ 200 V/cm), corona from aerials, wing and propeller tips, etc., carries the main discharge. Discharge by convection and atmospheric conductivity are unimportant.

Charging due to thunder conditions are discussed briefly. The fields at the aircraft surfaces due to this cause vary rapidly and can be very high (*e.g.* $\sim$3 000 V/cm) for short periods.

621.396.82 : 621.396.619.018.41 **1994**

Interference in Frequency Modulation.—N. Marchand. (*Communications*, Feb. 1946, Vol. 26, No. 2, pp. 38–40, 42.) A theoretical comparison of f.m. and a.m. receiver responses to adjacent-carrier, random-noise, and impulse-noise types of interference. The signal/noise ratio is in each case greater for f.m., particularly if de-emphasis is used. This paper is a sequel to 1675 of June.

621.396.82 : 621.396.619.018.41 **1995**

Effect of Common-Channel Interference on Frequency Modulation Broadcasting.—A. L. Durkee. (*Proc. Instn Radio Engrs, Aust.*, March 1946, Vol. 7, No. 3, pp. 10–11.) Reprint of 2591 of 1945.

621.396.823 : 621.365 : 621.315.551 **1996**

Interference with Broadcast Reception by Electrical Heating Apparatus.—W. Gerber & A. Werthmüller. (*Tech. Mitt. schweiz. Telegr. Teleph. Verw.*, 1st Dec. 1945, Vol. 23, No. 6, pp. 241–247. In German.) Domestic receivers usually take a considerable part of their h.f. power from the house power-supply wiring system. Consequently, interference can be caused by variations in the h.f. currents in the house wiring, resulting from periodic variation of the h.f. impedance of the wiring. Hum interference due to this cause is estimated to affect 20% of broadcast receivers. The hum tunes in with a received signal, and is sometimes thought by the listener to be due to modulation of the transmitter. It has previously been shown by the writers' department (evidently the Swiss Post Office—no reference is given to previous publications) that such interference is almost entirely associated with domestic heating appliances, and is due to the use of ferromagnetic alloys for the heating elements. The h.f. impedance of these elements varies with permeability, the permeability depends on the temperature of the heater, and the temperature varies at double the frequency of the alternating heating current. The ferromagnetic properties of the nickel-chromium-iron heater-wire alloys are discussed, and recommendations made for the selection of non-magnetic types. The nature of the interference modulation is discussed in some detail. The shunting of heating devices with by-pass capacitors is an effective method of reducing the interference.

STATIONS AND COMMUNICATION SYSTEMS

621.39 : 623.6 **1997**

Infantry Combat Communications.—R. E. Willey. (*Elect. Engng, N.Y.*, Jan. 1946, Vol. 65, No. 1, pp. 1–7.) A description of the radio and line, telephone and telegraph equipment used by the U.S. infantry. The range, frequency, and power output of various radio sets are given together with their uses in combat. Examples are quoted of communication problems encountered in action and unorthodox methods used in overcoming them.

621.395.1 **1998**

Communication System.—T. W. W. Holden. (*Radio, N.Y.*, March 1946, Vol. 30, No. 3, pp. 29, 48.) A device for securing voice transmission, using a frequency band much narrower than that usually required, by leaving " repetitious " waves out of the transmission and reintroducing them at the receiver. Summary of U.S. Patent 2 387 906.

621.395.4 **1999**

The Probability Distributions of Sinusoidal Oscillations Combined in Random Phase.—Slack. (*See* 1908.)

621.395.44 **2000**

The Unit Bay 1B Coaxial Cable Transmission System : Part 3.—R. A. Brockbank & C. F. Floyd. (*P. O. elect. Engrs' J.*, April 1946, Vol. 39, Part 1, pp. 14–17.) Continuation of 184 of January, describing the terminal repeater station equipment.

621.396.1 **2001**

Frequency Service Allocations.—P. D. Miles. (*Proc. Inst. Radio Engrs, N.Y.*, Part II, April 1946, Vol. 34, No. 4, pp. 188–192.) An account of the principles underlying the (U.S.) Federal Communications Commission's plan for frequency allocation announced in May, 1945.

621.396.1 **2002**

CAA Alaskan Diversity Receiving System : Part 2.—J. Ivers. (*Communications*, Feb. 1946, Vol. 26, No. 2, pp. 56–58, 61.) The rectified outputs from the eight diversity receivers are combined and used to key the output from an a.f. oscillator. The outputs from a number of diversity systems may be transmitted over one telephone line, using highly stable Wien-bridge oscillators on different audio frequencies. For part 1 see 1669 of June.

621.396.11.029.64 + 621.396.24 + 621.385.1 **2003**

Simultaneous Use of Centimeter Waves and Frequency Modulation.—Clavier & Altovsky. (*See* 1971.)

621.396.61.029.58 **2004**

200-Kilowatt High-Frequency Broadcast Transmitters.—Romander. (*See* 2061.)

621.396.619.16 **2005**

Pulse [width] **Modulation.**—A. T. Hickman. (*R.S.G.B. Bull.*, April 1946, Vol. 21, No. 10, pp. 150–153.) A typical modulation circuit is described and the frequency spectrum analysed.

621.396.619.16 **2006**

Pulse Modulation.—"Cathode Ray". (*Wireless World*, April 1946, Vol. 52, No. 4, pp. 113–117.) A discussion of the various types of modulation, explaining the advantages of pulse modulation at very high frequencies.

621.396.721 **2007**

Mobile 2 to 18 Mc/s Radioteletype for Long-Range Operation.—H. L. Landau. (*Communications*, Feb. 1946, Vol. 26, No. 2, pp. 36..74.) The AN/MRC-2, designed for tactical army use, has been installed in a railway coach and in an aircraft. A 2-kW transmitter, with frequency-shift keying, and dual space-diversity receivers are used. The transmitter is remotely controlled, and can be converted for hand keying.

621.396.82 : 621.396.619.018.41 **2008**

Interference in Frequency Modulation.—Marchand. (*See* 1994.)

621.396.97(73) **2009**

Broadcasting in U.S.A.—Report on Post-War Trends.—A. Dinsdale. (*Wireless World*, April 1946, Vol. 52, No. 4, pp. 132–135.) The economic position of American broadcasting, with its great dependence on advertising rents, is such that rapid development in television and in f.m. transmission is unlikely.

SUBSIDIARY APPARATUS

53 + 6] (73) **2010**

American Trends of Development in the Physical Sciences.—Overbeck. (*See* 2073.)

531.788 : 539.164.92 **2011**

Radium-Type Vacuum Gage.—Mellen. (*See* 1867.)

621–526 **2012**

On the Method of van der Pol and its Application to Non-Linear Control Problems [servo mechanisms]. —Bulgakov. (*See* 1907.)

621–526 **2013**

Theory of Servo Systems.—A. L. Whiteley. (*Electrician*, 29th March 1946, Vol. 136, No. 3539, pp. 823–824.) Summary and discussion of an I.E.E. paper.

621.3 **2014**

A.I.E.E. Winter Convention January 1946.—(*Elect. Engng, N.Y.*, Jan. 1946, Vol. 65, No. 1, pp. 29..35.) Abstracts are given of the following papers presented at the convention :—Applications of Thin Permalloy Tape in Wide-Band Telephone and Pulse Transformers, by A. G. Ganz. A B-H Curve Tracer for Magnetic-Recording Wire, by T. H. Long & G. D. McMullen. An Automatic Oscillograph with a Memory, by A. M. Zarem. Electronic Generator Voltage Regulator, by J. E. Reilly and C. E. Valentine. Titles of other papers are given in other sections.

For other abstracts see *Electronics*, April 1946, Vol. 19, No. 4, pp. 230..266.

621.314.2.017 **2015**

Thermal Characteristics of Transformers : Part 1. —V. M. Montsinger. (*Gen. elect. Rev.*, Apr. 1946, Vol. 49, No. 4, pp. 31–35, 38–42.) Power transformer loadings approved by the A.I.E.E. Standards are governed by the "eight degree" rule, which states that the rate of mechanical deterioration of Class A insulation is doubled for each eight degrees centigrade increase in temperature.

In determining the effect of high operating temperatures on the life of a transformer, measurement of the dielectric strength of the insulation is not a safe guide, since the determining factor is the ability of the materials involved to withstand abnormal mechanical stresses.

It has been found that the eight degree rule is fairly reliable in the range 115–200° C ; it decreases from eight degrees at 115° C, gradually, down to about three degrees at 75° C.

Practical temperature standards and other factors governing the design of transformer cooling systems are considered.

621.314.2.017 **2016**

Temperature Rise of Water-Cooled Power Transformers.—J. R. Meador. (*Gen. elect. Rev.*, Apr. 1946, Vol. 49, No. 4, pp. 55–59.)

621.314.22/.23 **2017**

The Impedances of Multiple-Winding Transformers : Part 2.—S. A. Stigant. (*Beama J.*, March 1946, Vol. 53, No. 105, pp. 109–114.) The derivation of the impedance tensor $Z_{\alpha\beta}$ and the construction of equivalent impedance network diagrams for *m*-winding transformers. For part 1 see 1685 of June. To be continued.

621.314.632.029.6 : 546.28 **2018**

H.F. Crystal Diodes.—LeDuc. (*See* 2077.)

621.314.65 : 621.396.71 **2019**

The Application of High-Voltage Steel-Tank Mercury-Arc Rectifiers to Broadcast Transmitters.—P. A. T. Bevan. (*J. Instn elect. Engrs*, Part III, March 1946, Vol. 93, No. 22, pp. 131–136.) Long abstract of 206 of January.

621.314.65 : 621.396.71 **2020**

High-Voltage Steel-Tank Mercury-Arc Rectifier Equipments for Radio Transmitters.—J. C. Read. (*J. Instn elect. Engrs*, Part III, March 1946, Vol. 93, No. 22, pp.128–130.) Long abstract of 205 of January.

621.316.54 **2021**

Fundamental Properties of the Vacuum Switch.—R. Koller. (*Phys. Rev.*, 1st/15th Feb. 1946, Vol. 69, Nos. 3/4, p. 134.) "An exhaustive study of the basic mechanism affecting the d.c. operation of the vacuum switch." Abstract of an Amer. Phys. Soc. paper.

621.316.86 : 546.281.26 **2022**

[Silicon-carbide] **Non-Ohmic Resistors.**–Ashworth, Needham & Sillars. (*See* 1885.)

621.317.35 **2023**

Complex Waveforms : The Harmonic Synthesiser.—Moss. (*See* 1917.)

621.317.755 **2024**

High Speed Oscillograph.—N. Rohats. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 135–137.) An oscillograph for transient measurements at writing speeds greater than 50 cm/μs using a sealed hot-cathode tube described in 3117 of 1937. A balanced thyratron sweep generator that can trigger or be triggered by the transient under observation is also described. Speeds up to several metres per microsecond may be used with a camera lens of aperture f/1.5.

621.318.572 **2025**

Electronic Contactors for Control Applications.—W. D. Macgeorge. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 186..206.) A survey of switch circuits using hard valves and hot- and cold-cathode relay tubes. Typical trigger requirements and power handling capacity are quoted.

621.318.572 : 531.76 : 539.16.08 **2026**

Experimental Arrangement for the Measurement of Small Time Intervals between the Discharges of Geiger-Müller Counters.—B. Rossi & N. Nereson. (*Rev. sci. Instrum.*, Feb. 1946, Vol. 17, No. 2, pp. 65–71.) A circuit is designed to give a voltage pulse of which the magnitude is a function of the time interval. The recovery time is sufficiently long to allow either visual observations or photographic recording with a c.r.t. Details are also given of an arrangement using a pen recorder.

621.319.4 : 621.317 **2027**

Capacitors for Measurement.—Garton. (*See* 1919.)

621.383 **2028**

[Photoelectric] **Electron Multipliers.**—E. Kormakova. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 62.) The multipliers described have semicircular emitters located on a cylindrical surface. Caesium-oxide surfaces, prepared on glass or nickel, are used as emitters and cathode. The cylindrical type with 10 or 12 emitters and a grid, has a sensitivity of 0.5–5 A/Lumen, with "dark" current 0.52 μA. Abstract of a paper of the Acad. Sci., U.S.S.R.

621.383 **2029**

Some Results of the Application of Principle of Secondary-Electron Transformation.—L. Kubetzky. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 62.) A highly sensitive photocell has been derived from a secondary electron mechanism. An efficient emitter of high stability has been discovered, being a combination of copper, sulphur, and caesium. A new photocathode with improved spectral characteristics is also mentioned. Abstract of a paper of the Acad. Sci., U.S.S.R.

621.383.2 + 535.215.1 **2030**

Complex Photoelectric Cathodes.—Khlebnikov. (*See* 1819.)

621.383.2 **2031**

New Sb-Cs Photocells.—N. Khlebnikov & A. Melamid. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 64.) Two new types, one for use down to 1900 Å and the other a highly sensitive (50μA/Lm) model showing no fatigue even at high cathode illumination (10 Lx). Abstract of a paper of the Acad. Sci., U.S.S.R.

621.383.2 **2032**

Energy Distribution of the Electrons and Dependence of Photocurrent for Caesium-Oxide Cathodes on the Angle of the Incidence of Light.—A. Pyatnitzky. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 64.) Semitransparent photocathodes on a glass surface were used, and the emission found to depend on the angle of incidence, wavelength, and cathode structure. The largest increase was found for an angle of incidence of 70°, when illuminated by blue light. Abstract of a paper of the Acad. Sci., U.S.S.R.

621.383.2 **2033**

Physical Properties of Silver-Caesium-Oxide Cathodes.—P. Morozov & M. Butslov. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, pp. 63–64.) The spectral distribution of the sensitivity of a caesium-oxide photocathode of variable thickness has been investigated, and found to be directly connected with the thickness. The structural peculiarity of the cathode leads to a spectral absorption and scattering of the incident light. The work function was found to be 0.78–0.90 V. Abstract of a paper of the Acad. Sci., U.S.S.R.

621.383.4 **2034**

A New Electrolytic Selenium Photo-Cell.—A. von Hippel, J. H. Schulman & E. S. Rittner. (*J. appl. Phys.*, April 1946, Vol. 17, No. 4, pp. 215–224.) ". . . consists of a metal electrode [cathode] completely coated with metallic selenium, immersed in an aqueous solution of an electrolyte, preferably selenium dioxide, together with an auxiliary electrode of a noble metal. . . ." "Our cell differs from . . . earlier electrolytic selenium cells chiefly in that directly electrodeposited metallic selenium gives rise to a higher sensitivity and that the selenious acid permits a higher lifetime as well as hermetical sealing of the cell . . ." A full description of the cell construction is given, with its characteristics as a function of operating voltage, temperature, external resistance, and time, and an account of its response to unmodulated, modulated, and monochromatic light. A feedback circuit is described, which greatly improves the voltage output of the photo-element and which "is generally applicable to photoconductive and photovoltaic cells."

621.383.5 **2035**

Photometric Equipment for Blocking-Layer Light-Sensitive Cells.—H. T. Wrobel & H. H. Chamberlain. (*Gen. elect. Rev.*, Apr. 1946, Vol. 49, No. 4, pp. 25–29.) A compact laboratory equipment for the quick and accurate testing of the temperature characteristics of barrier-layer selenium cells.

621.384.6 **2036**

Acceleration of Charged Particles.—(*Nature, Lond.*, 23rd March 1946, Vol. 157, No. 3986, pp. 381–382.) A brief review of 439 of February (McMillan) and of *Phys. Rev.*, 1945, Vol. 68, p. 233 (Kerst).

621.384.6 **2037**

A Proposed High Energy Particle Accelerator—The Cavitron.—R. F. Post. (*Phys. Rev.*, 1st/15th Feb. 1946, Vol. 69, Nos. 3/4, pp. 126–127.) A proposal for obtaining high intensity electron accelerating fields by replacing the usual " dee " assembly and acceleration chamber by an electromagnetic cavity resonator.

621.384.6 **2038**

Combination of Betatron and Synchrotron for Electron Acceleration.—H. C. Pollock. (*Phys. Rev.*, 1st/15th Feb. 1946, Vol. 69, Nos. 3/4, p. 125.) Comment on 439 of February (McMillan).

621.384.6.017.6 **2039**

Radiation Losses in the Induction Electron Accelerator.—J. P. Blewett. (*Phys. Rev.*, 1st/15th Feb. 1946, Vol. 69, Nos. 3/4, pp. 87–95.) A discussion of the possibility that, because of the high radial accelerations experienced by the electrons in an induction electron accelerator the radiation losses may introduce limitations in the design of accelerators for energies above 100 MeV. Radiation effects consistent with theoretical predictions have been observed. The radiation itself has not yet been detected.

621.385.832 : 621.396.9 **2040**

Cathode-Ray Tube Displays.—Bartlett, Watson & Bradfield. (*See* 1857.)

621.394.64 : 621.394.3 **2041**

Electronic Regeneration of Teleprinter Signals.—H. F. Wilder. (*Trans. Amer. Inst. elect. Engrs*, Jan. 1946, Vol. 65, No. 1, pp. 34–40.) A description of an electronic device for receiving weak and distorted teleprinter signals and retransmitting them in correct sequence. The received signal is corrected for time of duration by means of a timing delay network controlling balanced trigger circuits. Starting and stopping is performed by electronic bridge relays.

621.394.652 : 621.394.141 **2042**

An Electrical Keying Device.—F. Dearlove. (*R.S.G.B. Bull.*, March 1946, Vol. 21, No. 9, pp. 136–137.) An arrangement of a polarized relay to provide an automatic morse key. The device is simple, easy to adjust, uses no valves, is noiseless in operation, and is capable of very high speeds.

621.395.645.3 : 621.385.4 **2043**

Intermodulation Tests for Comparison of Beam and Triode Tubes used to drive Loudspeakers.—J. K. Hilliard. (*Communications*, Feb. 1946, Vol. 26, No. 2, pp. 15–17, 54.) The usual high distortion of the beam power valve is overcome by careful amplifier design with little negative feedback. The main requirement is for an output transformer with high self-impedance, high coupling coefficient, low distributed capacitance, and carrying capacity such that the output power shall be uniform over a wide frequency range. Intermodulation tests, which compare favourably with listening tests, showed that beam power amplifiers gave the same or less distortion than triodes, and have advantages of less hum and greater efficiency.

621.396.664 **2044**

An Interlocked Line-Switching System.—H. E. Adams. (*Communications*, March 1946, Vol. 26, No. 3, pp. 34–36.) For feeding programmes to any of four lines from either of two control rooms, with interlocking to prevent both control rooms from feeding the same line together. Description of the design, construction, and operation.

621.396.682 : 621.397.62 **2045**

Television Receiver R-F Power Supply Design.—H. C. Baumann. (*Communications*, March 1946, Vol. 26, No. 3, pp. 26 . . 70.) The advantage of using an r.f. (50–300 kc/s) oscillator, step-up transformer and rectifier to supply 10–50 kV 1 mA are outlined, and the design and construction of such an equipment are described. See also 2169 of 1943 (Schade).

621.396.69 **2046**

The Design of a Screened Room.—C. C. Eaglesfield. (*Electronic Engng*, April 1946, Vol. 18, No. 218, pp. 106–108, 112.) Detailed description of a room 10 ft × 8 ft × 8 ft high, made with copper sheet, giving an attenuation of outside interference of 100 db at frequencies 1–550 Mc/s. A fan outside provides forced ventilation, the air inlet and outlet apertures being covered with perforated zinc. Power supplies are introduced through low- and high-frequency filters designed to give the same attenuation as the screening.

621.396.69 **2047**

Post-War Components.—(*Wireless World*, April 1946, Vol. 52, No. 4, pp. 106–112.) A review of an exhibition by the Radio Component Manufacturers' Federation (Feb. 1946) which illustrates modern trends in design. A list of manufacturers and products is given.

621.396.69 : 06.064 **2048**

Reports on Exhibitions. — (*Electronic Engng*, April 1946, Vol. 18, No. 218, pp. 122–128.) Brief notes on some of the electronic equipment exhibited at the Institution of Electronics, Manchester, at the Radio Component Manufacturers' Federation Exhibition, and at the North-East Coast Exhibition.

621.396.91.087.5 : 551.51.053.5 **2049**

A Simple Kerr Modulator for Ionospheric Recording.—O. E. H. Rydbeck. (*Chalmers tekn. Högsk. Handl.*, 1945, No. 44, 13 pp. In English.) Detailed description of the design and construction of a Kerr cell suitable for replacing the point glow lamp used in certain types of ionosphere recording equipment.

771.448.1 : 778.39 **2050**

An Apparatus for Stroboscopic Observation.—S. L. de Bruin. (*Philips tech. Rev.*, Jan. 1946, Vol. 8, No. 1, pp. 25–32.) A capacitor discharge is used to provide repeated current impulses in a high-pressure argon tube, with time intervals of between 2 and 0.004 sec. Light flashes of about 10^{-5} sec duration are obtained.

TELEVISION AND PHOTOTELEGRAPHY

621.397 **2051**

Color Television on Ultra High Frequencies.—D.G.F. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 109–115.) The present C.B.S. system uses 525 lines, interlaced 2 : 1, the interlaced fields being scanned at 120 per sec. Improved definition is obtained with a 10-Mc/s bandwidth in the band 480–920 Mc/s, and single-sideband operation is eventually contemplated. The transmitter used a disk-seal triode (6C22) giving 1 kW peak or 600 W average ; a slotted waveguide radiator gives a concentration in the horizontal direction with a power gain of 20. The use of the vision flyback period for sound permits transmission up to 10 500 c/s. Of two receivers demonstrated, one gives direct vision of a 10-inch c.r. tube and the other an optical system giving a 17 × 22-inch picture. A tunable crystal mixer and 105-Mc/s i.f. amplifier with a bandwidth of 12 Mc/s gives an equivalent input noise level of 8 μV. The colour wheel uses standardized green, blue, and red filters, giving an average transmission of 14%. The required bright phosphor image is obtained with an accelerating voltage of 8 000. Details of the camera and pickup equipment are given.

621.397 **2052**

"Videosonic" Sound.—D. I. Lawson. (*Radio Craft*, March 1946, Vol. 17, No. 6, pp. 385..422.) For other descriptions of this system of transmitting sound and vision on one carrier see 459 of February and back references. See also *Electronics*, April 1946, Vol. 19, No. 4, pp. 208..212.

621.397 **2053**

Improved Phototelegraphy.—(*Electrician*, 22nd March 1946, Vol. 136, No. 3538, pp. 734–736.) A description and block diagram of a new phototelegraphic equipment designed at the (British) Post Office Research Station for overseas transmissions by Cable & Wireless Ltd.

621.397 **2054**

I.R.E. Winter Technical Meeting January 1946.—(*Communications*, Feb. 1946, Vol. 26, No. 2, pp. 22..66.) Abstracts of some of the papers read. For titles, see 1704 of June.

TRANSMISSION

621.314.65 : 621.396.71 **2055**

The Application of High-Voltage Steel-Tank Mercury-Arc Rectifiers to Broadcast Transmitters.—Bevan. (*See* 2019.)

621.385.3 **2056**

Grounded-Grid Power Amplifiers.—Spitzer. (*See* 2085.)

621.394.652 : 621.394.141 **2057**

An Electrical Keying Device.—Dearlove. (*See* 2042.)

621.396.11.029.64 + 621.396.24 + 621.385.1 **2058**

Simultaneous Use of Centimeter Waves and Frequency Modulation.—Clavier & Altovsky. (*See* 1971.)

621.396.61 **2059**

I.R.E. Winter Technical Meeting January 1946.—(*Communications*, Feb. 1946, Vol. 26, No. 2, pp. 22..66.) Abstracts of some of the papers read. For titles, see 1715 of June.

621.396.61.029.56 **2060**

A Self-Contained 60-Watt C.W. Transmitter.—D. Mix. (*QST*, Apr. 1946, Vol. 30, No. 4, pp. 13–17, 114.) The construction and adjustment of a set comprising a Tri-tet crystal oscillator driving an 807 output stage, for use in the 3.5, 7 and 14 Mc/s bands.

621.396.61.029.58 **2061**

200-Kilowatt High-Frequency Broadcast Transmitters.—H. Romander. (*Elect. Comm.*, 1945, Vol. 22, No. 4, pp. 253–261.) A technical description of two transmitters recently installed at Delano and Dixon (California). For a previous description of the circuit, see 787 of March.

The beam aerials are arranged in groups of three for each sector to be covered, the aerials of each group being graded so that a wide range of frequencies can be covered with uniform gain. The description is illustrated by photographs and circuit diagrams.

621.396.61.029.62 **2062**

Stabilizing the 144-Mc/s Transmitter.—G. Grammer. (*QST*, Apr. 1946, Vol. 30, No. 4, pp. 24–30.) Unwanted frequency modulation can be reduced by the use of a buffer amplifier between the master oscillator and the power amplifier. Constructional details are given for a 40-W three-stage (buffered) transmitter, and its performance is compared with that of two-stage and single-stage transmitters.

621.396.61.029.62 **2063**

The "Tiny Tim" Handie-Talkie.—C. T. Haist, Jr. (*QST*, Apr. 1946, Vol. 30, No. 4, pp. 58–59.) A pocket-size 144-Mc/s-band transceiver using two midget triodes as detector-oscillator and audio-amplifier/modulator. Range about one mile.

621.396.61.029.62 : 621.396.619.018.41 **2064**

250-Watt F.M. Transmitter for 88 to 108 Mc/s.—M. B. Kahn & S. L. Sack. (*Communications*, Feb. 1946, Vol. 26, No. 2, pp. 44..53.) The use of balanced reactance-modulators and a push-pull oscillator provides twice the frequency swing of a single modulator, so that only three doubler stages are necessary. Stabilization of centre frequency is obtained by mixing the output with the signal from a standard crystal oscillator, and passing the resulting a.m. and f.m. audio output to a phase detector. The d.c. voltage so obtained controls thyratrons which operate a motor that tunes the master oscillator. Frequency stability is better than ± 1 500 c/s.

621.396.61.029.63 **2065**

Oscillators and Amplifiers at 1 000 Mc/s.—P. S. Rand. (*QST*, Apr. 1946, Vol. 30, No. 4, pp. 34–40.) Detailed description (with diagrams and photographs) of the use of "Lighthouse" tubes and cavity resonators in a U.S. Navy 25-W 900-Mc/s transmitter. The modifications necessary for operation on 1 215 Mc/s are described.

621.396.611.21 : 621.396.615.14 **2066**

Frequency Stabilization at 450 Mc/s.—Myers. (*See* 1926.)

621.396.615.17 + 621.396.619 **2067**

Station Design and Planning : Part 3—Frequency Multiplication and Keying.—W. H. Allen. (*R.S.G.B. Bull.*, Feb. 1946, Vol. 21, No. 8, pp. 126–127.) Frequency-doubling circuit resembles power amplifier. Keying is best performed by grid-blocking of the oscillator. Necessary precautions are outlined. For part 1 see 1058 of April, for parts 2, 4 & 5 see 1801 and 1980.

621.396.619 : 621.396.619.018.41 **2068**

Reactance Tube Modulators.—N. Marchand. (*Communications*, March 1946, Vol. 26, No. 3, pp. 42–45.) Circuit equations for an f.m. source are derived, including cases of effective capacitive and inductive inputs. Distortion can be minimized by using balanced reactance tubes. A deviation of ± 3.75 kc/s is easily obtainable with a source frequency of 5 Mc/s and gives ±75 kc/s at a radiated frequency of 100 Mc/s. For previous parts in this series see 1675 of June and 1994.

621.396.645.3.029.5 **2069**

Station Design and Planning : Part 2—The Power Amplifier. Allen. (*See* 1801.)

621.396.664 **2070**

Radio-Frequency Transmitter.—J. N. Whitaker. (*Radio, N.Y.*, March 1946, Vol. 30, No. 3, p. 29.) A method of switching the tank circuits of an h.f. oscillator, without using metallic contactors. Summary of U.S. Patent 2 388 233.

621.396.676 : 621.396.932.029.54 **2071**

Radiation of Ship Stations on 500 Kc/s.—J. Marique. (*Wireless Engr*, May 1946, Vol. 23, No. 272, pp. 146–151.) A summary of the results of measurements made on the polar diagrams and range (in terms of metre-amperes) of a number of ship stations on about 500 kc/s—the frequency used for distress traffic. It was found that the horizontal polar diagram of typical ship aerials may show 2 : 1 variations of effective height with directions relative to the fore-and-aft line, and that the radiated power W_r can be represented by $W_r = (\text{Metre-amperes}/K)^2$, where $K^2 = \lambda^2/160\pi^2\alpha^2$, α being the "form factor" of the aerial. K lies between 25 and 50 at 454 kc/s.

The paper includes a graph showing the relation between field strength and distance for daytime conditions over sea as functions of aerial power and aerial height.

621.396.721 **2072**

Radio Amateur's Examination.—(*R.S.G.B. Bull.*, Feb. 1946, Vol. 21, No. 8, pp. 117–118.) The syllabus of the new [British] Radio Amateur's Examination of the City and Guilds Institute, the passing of which qualifies for a G.P.O. amateur transmitting licence.

VALVES AND THERMIONICS

53 + 6] (73) **2073**

American Trends of Development in the Physical Sciences.—C. J. Overbeck. (*J. sci. Instrum.*, Jan. 1946, Vol. 23, No. 1, pp. 1–10.) Includes disk-seal, radial-beam, and photo-multiplier tubes, and many other devices.

537.533 **2074**

On the Secondary Electron Emission of Solid Bodies.—S. Lukianov. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 62.) The emission is affected by (*a*) the total energy loss per unit length suffered by the primary particle, and (*b*) the range of the secondary electron in the given substance. The mean energy of formation of secondary electrons is estimated (in aluminium $E = 15\,\text{eV}$). The small emission of pure metals and the high emission of certain non-metals are discussed. Abstract of a paper of the Acad. Sci., U.S.S.R.

537.533 **2075**

On the Influence of Strong Electric Fields on the Secondary Electronic Emission of Dielectric Films.—D. Zernov. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, pp. 61–62.) The characteristics of emission from Al, Cs and Mg oxides are discussed, and the emission shown to depend on the primary current, collector potential, and velocity of the primary electrons. The secondary current practically ceases to follow primary-current variations at audio frequencies. Abstract of a paper of the Acad. Sci., U.S.S.R.

537.583 **2076**

The Emission of Oxide-Coated Cathode under Impulse Excitation.—A. Andrianov. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 60.) Experiments were made using diodes with concentric cylindrical electrodes. The current impulse was of 3–4 μs duration and the repetition frequency 50 c/s. The saturation current at different temperatures was measured. The volt/amp characteristic given by this method for small values of average current differs from that given by large values. Abstract of a paper of the Acad. Sci., U.S.S.R.

621.314.632.029.6 : 546.28 **2077**

H.F. Crystal Diodes.—H. A. LeDuc. (*Radio Craft*, March 1946, Vol. 17, No. 6, pp. 386, 428.) A short description of the theory, construction, and main uses in u.h.f. equipment, of stable cartridge-mounted germanium and silicon rectifiers. A table of the properties of eighteen types is added. See also 1728 of June.

621.38 **2078**

I.R.E. Winter Technical Meeting January 1946.—(*Communications*, Feb. 1946, Vol. 26, No. 2, pp. 22..66.) Abstracts of some of the papers read. For titles see 1730 of June.

621.383 **2079**

[Photoelectric] **Electron Multipliers.**—Kormakova. (*See* 2028.)

621.385.1 **2080**

Reflex-Klystron Oscillators.—E. L. Ginzton & A. E. Harrison. (*Proc. Inst. Radio Engrs, N.Y.*, Part I, April 1946, Vol. 34, No. 4, p. 209.) Correction to 1734 of June.

621.385.1 **2081**

What are the Klystron and the Rhumbatron?—J. Baltá Elias. (*Euclides, Madrid,* May/June 1945, Vol. 5, Nos. 51/52, pp. 287–297.) A simple account of the limitations of triode oscillators at u.h.f., and of the development of velocity-modulated oscillators.

621.385.1 + 621.385.16 **2082**

The Magnetron and the Klystron.—T. F. Wall. (*Engineering, Lond.,* 8th, 15th & 22nd Feb. 1946, Vol. 161, Nos. 4178–4180, pp. 125–127, 148 & 184–185.) Description of the mode of operation, including a simplified mathematical treatment. The discussion of the magnetron oscillator is limited to the split-anode type with external tuned circuit. Two-cavity klystron amplifiers and oscillators are considered.

621.385.1.029.63/.64 **2083**

The Klystron and Other Micro-Wave Oscillators.—A. C. Ramm. (*Proc. Instn Radio Engrs, Aust.,* Nov. 1945, Vol. 6, No. 5, pp. 3–4.) Summary of a talk on the development of Barkhausen-Kurz, magnetron, and klystron oscillators.

621.385.16 **2084**

Development of the Magnetron.—J. T. Randall. (*Electrician,* 1st March 1946, Vol. 136, No. 3535, pp. 537–538.) A summary of a paper read before the Royal Society of Arts describing the practical and theoretical development during the war.

621.385.3 **2085**

Grounded-Grid Power Amplifiers.—E. E. Spitzer. (*Electronics,* April 1946, Vol. 19, No. 4, pp. 138–141.) The lower capacitance of this amplifier permits wider-bandwidth operation than the conventional capacitance-neutralized triode, with reduced possibility of self-oscillation. Some 3–10 times greater driving power is needed, but this is transferred to the anode circuit. The 9C21 type (a 100-kW triode) is described; its use in an amplifier and its modulation characteristics are considered.

621.385.3/.5].012 **2086**

Pentodes and Tetrodes Operating as Triodes.—C. C. McCallum. (*Electronic Engng,* March 1946, Vol. 18, No. 217, pp. 82–83.) Chart showing, on a log-log plot, the r.m.s. input voltage and the a.f. output power for various triodes and triode-connected pentodes and tetrodes. A maximum second-harmonic distortion of 5% and the use of optimum load resistance is assumed. British and American types are included.

621.385.3/.5].032.24 **2087**

The Current to a Positive Grid in Electron Tubes: I. The Current Resulting from Electrons Flowing Directly from the Cathode to the Grid.—J. L. H. Jonker & B. D. H. Tellegen. **II. The Current Resulting from Returning Electrons.**—J. L. H. Jonker. (*Philips Res. Rep.,* Oct. 1945, Vol. 1, No. 1, pp. 13–32.) 1. Electron paths are calculated for the case of a planar triode by taking into account an extra velocity moment gained by electrons in passing close to the grid wires. This gives a second approximation to the expression for the direct electron current that agrees well with observed data. 2. The angular deflexions suffered by electrons in passage through one or more grids are investigated, and the electron current that returns to the positive grid is calculated from the proportion deflected through more than a certain critical angle. The effect of relative pitch in two grids is discussed in some detail.

621.385.3(091) **2088**

Saga of the Vacuum Tube: Parts 21 & 22.—G. F. J. Tyne. (*Radio News,* Feb. & April 1946, Vol. 35, Nos. 2 & 4, pp. 54–56, 130 & 52..133.) Concludes a survey of development in France and Germany during the first world war. For part 20 see 489 of February.

621.385.38 : 537.56 **2089**

Note on the Ionization and Deionization Times of Gas-Filled Thyratrons.—J. C. R. Cance. (*J. sci. Instrum.,* March 1946, Vol. 23, No. 3, pp. 50–52.) "The ionization time of G.T.1C thyratrons determined at currents ranging from 5 to 25 mA is shown to be independent of (*a*) anode current, (*b*) anode voltage, (*c*) rate of change of grid potential, and is sensibly constant at 1.4 ± 0.4 μsec. The relation between de-ionization time and negative grid voltage is illustrated graphically for different values of anode volts and current. At constant grid volts and anode current, the de-ionization time is shown to be independent of the magnitude of anode-cathode potential change used to effect extinction."

621.385.38 : 621.396 **2090**

Thyratrons and Their Applications to Radio Engineering.—A. J. Maddock. (*Elect. Comm.,* 1945, Vol. 22, No. 4, pp. 339–378.) A review of the nature, mechanism, and characteristics of thyratrons, of the range of existing types, and of the main types of controlling circuits in which they are used, illustrated by application to operation timing, peak voltmeters, overload relays, overmodulation indicators, frequency meters, d.c. amplification, transmitter keying, pulse generation, c.r. tube switching and time bases, harmonic generators, frequency dividing, power-supply regulation and control, rectification, and inversion. The paper is illustrated by numerous typical circuit-diagrams and has a bibliography of 66 items.

621.385.4 **2091**

Beam Tetrode Characteristics.—S. Rodda. (*Wireless Engr,* May 1946, Vol. 23, No. 272, pp. 140–145.) The anode-current/anode-voltage characteristic is deduced on the assumption that the electrons entering the screen/anode space have a distribution in angle given by a continuous function of the sine of the angle of entry. (Previous treatments have assumed a discontinuous function.) Even with the continuous distribution in angle, the action of space charge produces "regions of instability" with "sharp knees". See also 1807, 2222 and 2635 of 1945 (Walker).

621.385.5 : 621.396.619 **2092**

New Modulation Tube for Frequency Modulation.—(*Electronics,* Feb. 1946, Vol. 19, No. 2, pp. 204..212.) An illustrated account of the "phasitron" described in 1405 of May.

621.396.615.17 : 621.317.755 **2093**

Time-Base Converter and Frequency-Divider.—H. Moss. (*Wireless Engr,* May 1946, Vol. 23, No. 272, p. 152.) A letter supporting the writer's previous contention that the introduction of new types of components is only justified by a substantial technical advantage to be gained, and that the case for such technical advantage is not valid in the case of the deflexion-modulated valves ("signal-converters") proposed by Nagy and Goddard in their original paper. See 3891 of 1945 and 3393 of 1943.

MISCELLANEOUS

003.6 : 621.392.5 **2094**

Graphical Symbols for Filters and Correcting Networks.—G. H. Foot. (*Wireless Engr*, April 1946, Vol. 23, No. 271, pp. 103–106.) Suggested new symbols based on the shape of the performance graph of attenuation against frequency.

519.283 : 621.315.617.3 **2095**

Quality Control of Insulating Varnishes.—Hart. (*See* 1883.)

62 "1945" **2096**

Progress in Engineering Knowledge during 1945 : Design Engineering.—P. L. Alger, J. Stokley, C. F. Scott, H. B. Marvin, J. L. Tugman, K. W. Given. (*Gen. elect. Rev.*, Feb. 1946, Vol. 49, No. 2, pp. 9–19.) A review, with an extensive bibliography, of many fields, including the solution of partial differential equations by equivalent electrical circuits, the measurement and recommended field strength limits for interference from electrical apparatus, improvements in television fluorescent-screen construction, and a combined triode-cavity resonator for radar applications.

621.316.96 : [621.38/.39 **2097**

Vibration and Shock Testing of Mobile Equipment.—J. H. Best. (*Electronics*, April 1946, Vol. 19, No. 4, pp. 126–129.) Testing techniques for newly developed anti-vibration mountings for electronic equipment. In addition to a test on the unmounted unit for vibration resonance of any particular part over a range of frequencies, data are obtained on the vibration-isolation efficiency of the mount itself. Vibration tests in three mutually perpendicular directions are made, and account taken of any tendency for torsional oscillation.

621.396.6 **2098**

Naval Wartime Communication Problems.—J. O. Kinert. (*Proc. Inst. Radio Engrs, N.Y.*, Part II, April 1946, Vol. 34, No. 4, pp. 193–195.) As a result of experience gained during the war the following recommendations are urged for the design of military equipment :—(*a*) the greatest simplification consistent with satisfactory performance ; (*b*) the maximum practicable reduction in weight and size ; (*c*) standardization of parts and components ; (*d*) maximum use of automatic features.

621.396(73) **2099**

Those New Frontiers.—P. A. Porter. (*Proc. Inst. Radio Engrs, N.Y.*, Part II, April 1946, Vol. 34, No. 4, pp. 185–188.) A general discussion of the future of radio engineering in America.

621.396 "1945" **2100**

Radio Progress During 1945.—(*Proc. Inst. Radio Engrs, N.Y.*, Part II, April 1946, Vol. 34, No. 4, pp. 164–184.) Survey of world progress, based on a bibliography of over 400 references.

621.396.6(083.75) **2101**

Proposed Standards of the [U.S.] **Radio Manufacturers' Association.**—(*Proc. Inst. Radio Engrs, N.Y.*, Part II, April 1946, Vol. 34, No. 4, pp. 198–200.) Summaries of proposals 163–169, concerned with details of receivers, gramophone records, and valve type designations.

621.396.712 **2102**

From Studio to Master Control.—H. J. Seitz. (*Radio News*, Jan. 1946, Vol. 35, No. 1, pp. 47..158.) Description of the various duties of the broadcast engineer, including field broadcasting, maintenance, master control, and studio operation, the latter being concerned with acoustics and realistic reproduction.

621.396.721 **2103**

Radio Amateur's Examination.—(*See* 2072.)

621.798 **2104**

Protective Packaging.—O. C. Rutledge. (*Gen. elect. Rev.*, Dec. 1945, Vol. 48, No. 12, pp. 16–19.) A review of new methods for protecting equipment against corrosion and shock while in storage or in transit.

621.798 **2105**

Dynamics of Package Cushioning.—R. D. Mindlin. (*Bell Syst. tech. J.*, July/Oct. 1945, Vol. 24, Nos. 3/4, pp. 353–461.) A comprehensive analysis of the protective cushioning necessary in the transportation of packaged articles. The four parts of the paper are concerned with (*a*) methods for predicting the maximum acceleration that the cushioning permits the packaged item to reach, (*b*) the form of the acceleration/time relation, (*c*) the effect of acceleration on the packaged article with methods for determining whether or not the strength of the packaged article will be exceeded, (*d*) the influence of distributed mass and elasticity in both the packaged article and cushioning medium. The results of the analysis have been applied to the packaging of large vacuum tubes.

621.798 : 621.396.69 **2106**

Hermetic Sealing.—A. L. Anderson. (*Radio, N.Y.*, March 1946, Vol. 30, No. 3, pp. 25–27, 46.) Describes the technique of filling an enclosure with inert gas under a pressure of 5–10 lb/sq inch above atmospheric. See also 811 of March (Herbert).

654.19 **2107**

1946 Radio Statistics.—(*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, p. 63.) Figures for the production of broadcast receivers in the years 1922–1945.

016 : [621.38/.39 **2108**

The Electronic Engineering Master Index. [Book Review]—F. A. Petraglia (Ed.). Electronics Research Publishing Co., New York, 1945, 318 pp., $ 17.50. (*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, p. 128.) "A comprehensive and painstaking subject index of electronic engineering periodicals covering, in separate sections, the two decades from 1925 to June 1945."

5 (082.2) **2109**

The Autobiography of Science. [Book Review]—F. R. Moulton & J. J. Schifferes (Eds.). Doubleday, Doran & Co., New York, 1945, 666 pp., $ 4.00. (*Sci. Mon., N.Y.*, Dec. 1945, Vol. 61, No. 6, pp. 489–491.) Selections from original scientific writings of historical interest. ". . . an excellent effort to offer the best in scientific literature. . ."

519.283 **2110**

Statistical Analysis, Quality Control, etc. [Book Reviews]—(*ASTM Bull.*, Jan. 1946, No. 138, pp. 60–62.) Reviews of 13 books and pamphlets condensed from *J. Amer. Statistical Assoc.*, Sept. 1945.

ABSTRACTS AND REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

517·947·44 : 534·25 **2111**

The Wave Equation in a Medium with a Variable Index of Refraction.—Bergmann. (*See* 2170.)

534·2 **2112**

Absorption and Scattering by Sound Absorbent Cylinders.—R. K. Cook & P. Chrzanowski. (*J. acoust. Soc. Amer.*, April 1946, Vol. 17, No. 4, pp. 315–325.) Theoretical and experimental studies, with fairly good agreement between them.

534·213·4 **2113**

Attenuation of Sound in Circular Ducts.—E. Fisher. (*J. acoust. Soc. Amer.*, April 1946, Vol. 17, No. 4, p. 338.) Correction to 257 of February.

534·231·3 **2114**

The Driving-Point Impedance of an Infinite Solid Plate.—R. Clark Jones. (*J. acoust. Soc. Amer.*, April 1946, Vol. 17, No. 4, pp. 334–336.) In the design of mechanical filters for preventing the transmission of vibration from one structure to another it is necessary to know the impedances of the structures between which the filter is to be connected. Expressions for these impedances are derived, and the results applied to the case of a steel plate. Full paper, of which abstract was noted in 4089 of 1945.

534·43 : 621·395·61 **2115**

Phonograph Reproducer Design.—W. S. Bachman. (*Trans. Amer. Inst. elect. Engrs*, March 1946, Vol. 65, No. 3, pp. 159–162.) Description of the design and performance of two devices depending on the principle of the resistance-wire strain gauge. A variable-reluctance magnetic reproducer is also described.

534·771 **2116**

Monitored Live-Voice as a Test of Auditory Acuity.—R. Carhart. (*J. acoust. Soc. Amer.*, April 1946, Vol. 17, No. 4, pp. 339–349.) A statistical comparison between two methods of measuring deafness.

534·833 : 534·61 **2117**

A Small Acoustical Tube for Measuring Absorption of Acoustical Materials in Auditoriums.—D. P. Love & R. L. Morgan. (*J. acoust. Soc. Amer.*, April 1946, Vol. 17, No. 4, pp. 326–328.) Useful over a frequency range 200–1 000 c/s.

534·833·1 **2118**

Demountable Soundproof Rooms.—W. S. Gorton. (*Bell Lab. Rec.*, April 1946, Vol. 24, No. 4, pp. 150–154.) See also 1753 of July and 825 of April.

534·861·1 **2119**

Acoustical Treatment of Broadcast Studios.—J. B. Ledbetter. (*Radio, N.Y.*, Feb. 1946, Vol. 30, No. 2, pp. 17..62.) A review of the requirements for studios of various sizes and the methods used to obtain the optimum reverberation time.

621·395·613·32 **2120**

Microphones: Part 3 — Pressure-Operated Microphones.—S. W. Amos & F. C. Brooker. (*Electronic Engng*, June 1946, Vol. 18, No. 220, pp. 190–192.) Early examples of carbon granule microphones of both telephone and Reisz transverse current types are compared with the modern telephone inset and the double-button microphone. Frequency response curves are given, and the disadvantages of carbon types are listed. An early form of moving coil microphone, the Magnetophone, is mentioned. For previous parts see 1755 of July.

621.395.613.38 + 621.395.623.6] : 621.317.79 **2121**

Laboratory Method for Objective Testing of Bone Receivers and Throat Microphones.—E. H. Greibach. (*Trans. Amer. Inst. elect. Engrs,* April 1946, Vol. 65, No. 4, pp. 184–187.) An account of the production and the performance of an artificial throat for test purposes.

621.395.613.38 **2122**

Inertia Throat Microphones.—E. H. Greibach & L. G. Pacent. (*Trans. Amer. Inst. elect. Engrs,* April 1946, Vol. 65, No. 4, pp. 187–191.) The theory and design of a magnetic microphone, with a frequency response 100 – 5 000 c/s, with a sharp h.f. cut-off.

621.395.623.34 **2123**

Conical Sound Source.—P. G. Bordoni. (*J. acoust. Soc. Amer.,* April 1946, Vol. 17, No. 4, p. 338.) Correction to 266 of February.

621.395.623.7 **2124**

New Permanent Magnet Public Address Loudspeaker.—J. B. Lansing. (*J. Soc. Mot. Pict. Engrs,* March 1946, Vol. 46, No. 3, pp. 212–219.) A Duplex loudspeaker, with high efficiency, wide frequency range, large distribution angle, and small physical size. The use of special types of baffle with the speaker for public address systems is discussed. Improved response is obtained by ribbon coil construction, increased magnetic flux, and a large voice coil.

621.395.625 **2125**

A Report on the Sixth Annual Conference of Broadcast Engineers.—L. Winner. (*Communications,* April 1946, Vol. 26, No. 4, pp. 30..74.) Long illustrated summaries of the following papers :—Magnetic Recording, by S. J. Begun. Tools for the Study of Disk Recording Performance, by H. E. Roys. For other papers see 2143, 2319 and 2365.

621.395.625.2 : 621.396.933.4 **2126**

Recording C.A.A. Traffic Control Instruction.—K. M. MacIlvain. (*Electronics,* May 1946, Vol. 19, No. 5, pp. 116–119.) Automatic equipment records two-way communications between control centre and aircraft pilots on a flexible plastic belt, giving 30 minutes of continuous recording, which can be stored for reference. There are separate recording and reproducing heads and amplifiers which can be operated simultaneously, the reproduction can be within one second of the recording.

621.395.625.3 **2127**

A New Wire Recorder Head Design.—T. H. Long. (*Trans. Amer. Inst. elect. Engrs,* April 1946, Vol. 65, No. 4, pp. 216–220.) Description of a design that distributes wear, and results in a head that is virtually self-cleaning.

621.395.625.6 **2128**

Stereophon Sound Recording System.—C. Becker : H. B. Lee. (*J. acoust. Soc. Amer.,* April 1946, Vol. 17, No. 4, pp. 356–357.) A brief description of a system developed in Germany since 1938 for high-quality sound recording on film. " The system employs well known means in some respects, but has the important advantage of giving excellent 3-channel reproduction of great dynamic range and low noise level using a sound track of total width only 2.65 mm."

621.395.8 : 621.317.79 **2129**

The Measurement of Audio Distortion.—Scott. (*See* 2253.)

AERIALS AND TRANSMISSION LINES

621.315.21.029.5/.6 **2130**

Report of Conference on Radio-Frequency Cables.—(*Trans. Amer. Inst. elect. Engrs,* December Supplement 1945, Vol. 64, pp. 911–941.) A symposium of 17 short papers as follows :—1. The Development of Radio-Frequency Cables in the United States, by J. H. Neher. 2. General Characteristics of Polyethylene, by J. W. Shackleton. 3. Polyethylene as Cable Insulation, by C. S. Myers & A. E. Maibauer. 4. Dielectric Strength of Polyethylene, by W. A. Del Mar. 5. Properties of Different Polyethylenes, by W. J. Clarke. 6. Radio-Frequency-Cable Manufacturing Methods, by T. M. Odarenko. 7. General Considerations in Radio-Frequency-Cable Design, by J. F. Wentz. 8. Losses in Radio-Frequency-Cable Components, by G. L. Ragan. 9. Radio-Frequency-Cable Power Ratings and Stability, by M. C. Biskeborn. 10. Shielding Characteristics of Radio-Frequency Cables, by R. G. Fluharty. 11. Types of Radio-Frequency Cables and Specifications, by E. E. Sheldon. 12. Design Considerations of High-Frequency Twin-Conductor Cable, by E. W. Greenfield. 13. Methods of Electrical and Mechanical Testing of Radio-Frequency Cables at the Naval Research Laboratory, by J. M. Miller. 14. Electrical Tests Over a Range of Frequencies, by C. C. Fleming. 15. The S-Function Method of Measuring Attenuation of Coaxial Radio-Frequency Cable, by C. Stewart, Jr. 16. Corona-Initiation Measurements on Polyethylene and Rubber Cables, by D. Depackh. 17. A Corona Voltmeter, by A. E. Widmer. Discussions of the papers grouped by subject are summarized.

621.315.212.1 : 621.39] (091) **2131**

Historic Firsts : The Coaxial System.—(*Bell Lab. Rec.,* April 1946, Vol. 24, No. 4, pp. 148–149.)

621.315.212.1 : 621.392.2 **2132**

Design Data for Beaded Coaxial Lines.—C. R. Cox. (*Electronics,* May 1946, Vol. 19, No. 5, pp. 130–135.) Equations and curves are given for the determination of the characteristic impedance, optimum insulator spacing, attenuation, and maximum power rating. The choice of insulator materials and bead shapes is discussed. Standard attenuation curves are given for 70-ohm broadcast cables, and for 51.5-ohm cables used in f.m. and television equipment.

621.392 **2133**

The Experimental Behaviour of the Coaxial Line Stub.—J. Lamb. (*J. Instn elect. Engrs,* Part III, May 1946, Vol. 93, No. 23, pp. 188–190.) An experimental counterpart of the theoretical paper by Allanson, Cooper and Cowling (see 2134 below) at wavelengths of about 8 and 11 cm. A standing-wave detector with a very small probe energizing a thermocouple gives the impedance, using Bruckmann's method (2904 of 1938), from which a circle diagram is constructed. The stub susceptance is expressible in the form $[A \cot 2\pi (y - p_2)/\lambda] + B$ where y is the stub length and p_2 the distance of the first characteristic point from the stub entry.

621.392 **2134**

The Theory and Experimental Behaviour of Right-Angled Junctions in Rectangular-Section [H_{01}] **Wave Guides.**—J. T. Allanson, R. Cooper & T. G. Cowling. (*J. Instn elect. Engrs*, Part III, May 1946, Vol. 93, No. 23, pp. 177–187.) A theoretical analysis of a waveguide junction of *n* members made in terms of an equivalent transmission-line system is applied to the problem. "The behaviour is expressed in terms of six parameters, the values of which have been calculated over a range of wavelengths around 10 cm and determined experimentally at four points within this range. A description of the experimental technique employed is given, and an assessment made of the order of accuracy attained in the measurements."

621.392 **2135**

Normal Modes in the Theory of Wave Guides.—G. M. Roe. (*Phys. Rev.*, 1st/15th March 1946, Vol. 69, Nos. 5/6, p. 255.) When the boundaries are not perfectly conducting there is only a finite number of non-orthogonal modes satisfying the continuity conditions and the conditions at infinity. Abstract of an Amer. Phys. Soc. paper.

621.392 **2136**

Engineering Approach to Wave Guides.—T. Moreno. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 99–103.) The advantages of waveguides over coaxial air- and solid-dielectric cables in the frequency range 2–30 kMc/s are described in relation to attenuation and power-carrying capacity. Design data and waveguide materials are discussed, and a list of standard guide sizes for various frequency ranges is given.

621.392.012.2 **2137**

New Transmission-Line Diagrams.—A. C. Schwager & P. Y. Wang. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1945, Vol. 64, p. 955.) Discussion of 548 of March.

621.392 : 621.396.67 **2138**

Feeding Combined F.M. and A.M. Antenna Arrays.—W. Pritchett. (*Electronic Industr.*, April 1946, Vol. 5, No. 4, pp. 72–74.) Briefly describes two previous methods (2118 of 1941—Taylor, & 3834 of 1945—Alford), and a third method by which open-wire transmission lines are used with stub matching to separate the signals before applying them to their respective aerials.

621.392.21 : 621.315.1 + 621.396.664] : 621.396.712 **2139**

The Design and Use of Radio-Frequency Open-Wire Transmission Lines and Switchgear for Broadcasting Systems.—F. C. McLean & F. D. Bolt. (*J. Instn elect. Engrs*, Part III, May 1946, Vol. 93, No. 23, pp. 191–210.) Main points discussed are :—the characteristic impedances, breakdown voltages, and attenuation of 2-, 4- and other multi-wire lines ; the method of construction and support as used in high power transmitters ; the systems of manual and automatic switching between a number of lines, and the influence of open-air operation ; the matching of balanced lines, and the relation between the standing-wave ratio and the power-handling capacity of the line ; the characteristics and costs of typical line systems. The work described is that of the B.B.C. high-power broadcast stations at frequencies from 0.2 to 25 Mc/s.

621.396.67 + 621.396.11 **2140**

A Note on a Simple Transmission Formula.—Friis. (*See* 2282.)

621.396.67 **2141**

Concerning Hallén's Integral Equation for Cylindrical Antennas.—S. A. Schelkunoff : R. King. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, pp. 265–269.) Discussion by King of 851 of April. Comparative tables are given of experimental and theoretical values of the significant resonant parameters of aerials having $\Omega \equiv 2 \ln (2l/a) = 10$, 15 and 20. Schelkunoff, in replying, points out that Hallén's first approximation as used by King in his series of papers gives considerable errors and only the latest King and Middleton paper (1453 of June) gives results of the right order.

621.396.67 **2142**

"Cloverleaf" Antenna for F.M. Broadcasters.—(*Bell Lab. Rec.*, April 1946, Vol. 24, No. 4, pp. 163–164.) Note on an array giving a horizontal sheet of horizontally polarized rays, eliminating multiple transmission lines, phase-correcting networks, balancing lines etc. See also paper by P. H. Smith, referred to in 2143.

621.396.67 **2143**

A Report on the Sixth Annual Conference of Broadcast Engineers.—L. Winner. (*Communications*, April 1946, Vol. 26, No. 4, pp. 30..74.) Long illustrated summaries of the following papers :—Circular Antennas, by M. W. Scheldorf. F-M Broadcast Loops, by A. G. Kandoian. Super Turnstile Antenna, by R. F. Holtz. The Clover-Leaf F-M Antenna, by P. H. Smith. For other papers see 2125, 2319 and 2365.

621.396.677 **2144**

Vertical Rhombics.—T. J. White. (*Radio Craft*, April 1946, Vol. 17, No. 7, pp. 469, 509.) A side-length of 49 ft and vertical diagonal of 41 ft were found to be the best dimensions for use at 3–4.2 metres. Other constructional details, and the advantages of vertical rhombics over both horizontal rhombics and vertical dipole arrays are discussed.

621.396.677 **2145**

An Umbrella-Type Antenna.—A. K. Robinson. (*QST*, May 1946, Vol. 30, No. 5, pp. 70–73.) A number of radial wires slant downwards from a mast and are terminated by resistances to earth. A switching box at the top of the mast selects any pair of adjacent wires to give a sloping-Vee aerial for reception directive in elevation and azimuth. It is shown how the radiation lobes of a single wire of length 4λ combine with ground images and with the lobes of an adjacent wire. A variable-frequency oscillator is used for the adjustment of the terminating resistances, and practical results are given.

CIRCUITS

621.3.011.3 : 621.3.012.3 **2146**

Nomogram for Computing Inductance of Straight Cylindrical Wires.—J. I. Stephen. (*Communications*, April 1946, Vol. 26, No. 4, pp. 48–49.)

621.318.572 **2147**

Design of Counter Circuits.—E. R. Jacobson. (*Radio, N.Y.*, Feb. 1946, Vol. 30, No. 2, pp. 25..59.) Description of a double-diode circuit for repetition-rate indication, giving a d.c. output proportional to the frequency of the applied impulses.

621.318.572 **2148**

Gate Circuit for Chronographs.—L. B. Tooley. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 144–145.) A simple circuit, including two thyratrons fired by successive pulses applied to the input, which can be used as a switch controlling the time of operation of a counter system.

621.385.3 : 621.396.615 **2149**

Circuits for Sub-Miniature Tube.—F.R. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 154–156.) Characteristics are given of the 6K4, a miniature triode suitable for a.f. and r.f. circuits ; design data are given, and circuits suggested for its use in v.h.f. line-oscillators. The mechanical properties of the valve fit it for use in apparatus subject to vibration.

621.392 **2150**

Theorem on Equivalent Representations of an Arbitrary Linear Network.—E. J. Schremp. (*Phys. Rev.*, 1st/15th March 1946, Vol. 69, Nos. 5/6, pp. 259–260.) Abstract of an Amer. Phys. Soc. paper.

621.392.4.012.3 **2151**

Phase-Shifter Nomograph.—R. E. Lafferty. (*Electronics*, May 1946, Vol. 19, No. 5, p. 158.) For calculating the component values of a bridge-type phase-shifting network with a range from 0° to 180°.

621.394/.397].645.2 : 621.392.5 **2152**

Theory and Design of Double-Tuned Circuits.—A. M. Stone & J. L. Lawson. (*Electronic Industr.*, April 1946, Vol. 5, No. 4, pp. 62–68..128.) A detailed analysis giving the exact solution of shunt-fed, double-tuned, wide-band networks using inductive coupling, and of the equivalent T and π circuits. The results are shown graphically. Special applications considered are (*a*) video-frequency amplifier interstage coupling, (*b*) i.f. amplifier interstage coupling (15 Mc/s wide, 30 Mc/s mean), (*c*) coupling of i.f. amplifier to line, (*d*) coupling of frequency converter to i.f. amplifier.

621.395.645.2 : 621.395.813 **2153**

Radio Design Worksheet : No. 45—[Harmonic distortion in] **Non-Linear Resistances ;** [and effect on gain of] **Amplifier Coupling.**—(*Radio, N.Y.*, Feb. 1946, Vol. 30, No. 2, pp. 33–34.)

621.394/.397].645.3 **2154**

Balanced Output Amplifiers of Highly Stable and Accurate Balance.—E.M.I. Laboratories. (*Electronic Engng*, June 1946, Vol. 18, No. 220, p. 189.) A pair of amplifying valves have a common cathode circuit with the usual resistor replaced by a valve that is controlled from a potential divider connected between the anodes of the two amplifiers. The resulting stability and accurate balance is obtained without excessive potential drop in the cathode circuit.

621.395.645.3 **2155**

High-Fidelity All Purpose Amplifier.—R. T. Rogers & M. Putman. (*Radio News*, April 1946, Vol. 35, No. 4, pp. 32–34.) Details of the circuit and performance of a 30-W a.f. amplifier with negative feedback and bass and treble controls. The noise level is 50 db below maximum output and the distortion less than 4%.

621.396.611.21 **2156**

Forced Vibrations of Piezoelectric Crystals.—H. Ekstein. (*Phys. Rev.*, 1st/15th March 1946, Vol. 69, Nos. 5/6, p. 257.) Abstract of an Amer. Phys. Soc. paper.

621.396.615 **2157**

Two-Terminal Oscillator.—M. G. Crosby. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 136–137.) A twin triode is connected with one triode as a cathode follower driving the second triode through the common cathode resistance. The input-output transconductance is negative, so that an oscillator can be made by two-point connexion of a tuned circuit. Several applications are given, including the use of the circuit as a class-A limiter and as a true square-wave multivibrator.

621.396.615.11/.12 **2158**

A Wide-Range Test Oscillator.—C. F. Lober. (*QST*, May 1946, Vol. 30, No. 5, pp. 40–42.) Constructional details of an RC oscillator for 17–218 000 c/s sine- or square-wave, using a Wien-bridge circuit.

621.396.615.17 + 621.318.572 **2159**

Pulsing Circuits for Timing Applications.—R. L. Rod. (*Radio, N.Y.*, Feb. 1946, Vol. 30, No. 2, pp. 27–30, 60.) Circuit details of the clipped-sine-wave pulse-generator, the self-running and triggered multivibrator, the blocking oscillator, the triggered-blocking-oscillator dividing-circuit, the triggered-transitron pulse-generator, a simple circuit for pulse-width discrimination, the pentode gating-circuit, and a triode coincidence-indicator.

621.396.615.17 **2160**

Controlled and Uncontrolled Multivibrators.—E. R. Shenk. (*Proc. Radio Cl. Amer.*, Feb. 1946, Vol. 23, No. 2, 18 pp.) An analysis, on the basis of capacitor-resistor time constants, gives an equation relating the natural frequency to the characteristics of the valves and to the circuit components. The conditions to be satisfied in a synchronized multivibrator to allow for variations in the circuit time constants are deduced, and the waveform and phase of the synchronizing voltage are considered. Percentage variations in the frequency of the synchronizing pulses over which a given order of division can be maintained and the application of either positive or negative pulses are discussed. Design curves are included, and worked examples are given.

621.396.615.17 **2161**

Waves and Pulses.—J. McQuay. (*Radio Craft*, April 1946, Vol. 17, No. 7, pp. 470..499.) The basic principles of pulse formation, followed by brief details of eight pulse-producing circuits.

621.396.615.17 : 621.317.755 **2162**

Single Sweep [timebase] **Generator.**—D. McMullan. (*Radio, N.Y.*, Feb. 1946, Vol. 30, No. 2, pp. 4, 8.) Illustrated summary of 571 of March.

621.396[.619 + .621.53 **2163**

The Calculation of Intermodulation Products by Means of a Difference Table.—A. Bloch. (*J. Instn elect. Engrs*, Part III, May 1946, Vol. 93, No. 23, pp. 211–216.) The method of central differences used by Espley (3872 of 1940) is applied to the intermodulation products in a nonlinear device fed with two voltages of different frequency. Sheppard's difference and average operators δ and μ are applied, and the evaluation carried out in terms of the function $F^p_k(a)$ which is tabulated in the paper.

621.396.662.3 : 621.396.611.21 **2164**

The Crystal Filter : Parts 1 & 2.—R. W. Ehrlich. (*Radio Craft*, March & April 1946, Vol. 17, Nos. 6 & 7, pp. 398..442 & 476..507.) An elementary account of the principles and applications.

621.396.662.34 : 621.396.44 : 621.396.611.21 **2165**

A New Crystal Channel Filter for Broad Band Carrier Systems.—E. S. Willis. (*Trans. Amer. Inst. elect. Engrs*, March 1946, Vol. 65, No. 3, pp. 134–138.) Four crystal units are assembled in one lattice-type filter section, with substantial savings of weight and space. Attenuation of 50–60 db is obtained for frequencies more than 700 c/s from the edge of the pass band, which is about 3 kc/s wide. Temperature changes of 20° F alter the frequency by 0.03%.

621.396.69 **2166**

Printed Circuit Wiring.—(*See* 2229.)

621.396.82 : 621.317.79 **2167**

Cylindrical Shielding and Its Measurement at Radio Frequencies.—A. R. Anderson. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, pp. 312–322.) "The effectiveness of shields from the point of view of the wave theory of shielding is discussed. Specific consideration is given to cylindrical shielding against low-impedance fields and its measurement at radio frequencies. Various methods and concepts of measurement are discussed briefly; inadequacy of probe-type tests and the advantages of an integrating-type test are pointed out.

"Equipment of the integrating type suitable for production testing of specimens of cylindrical shielding from 3/16 to 2 inches diameter at 3 Mc/s is described and illustrated. With this equipment, shielding effectiveness of the unknown is determined in terms of the effectiveness of a specified rigid metal-tube standard. Sensitivity is sufficient to measure the leakage through 0.024 inch of copper at the test frequency. A shielded room is not required.

"Experimental results obtained with this and similar equipment from 200 kc/s to 10 Mc/s are given. Tests at various frequencies on thin-wall copper tubes of different thicknesses are shown to be in agreement with the results predicted by theory. Included are data on metal tubes, wire braids, coaxial cable, and flexible-shielding conduits.

"Test results are shown to be independent of current through the specimen, receiver gain or adjustment, and various other factors. Results are shown also, in general, to be independent of the length of specimen tested and its impedance. Various factors affecting test results are considered and formulas are given for correcting results obtained on exceptional specimens having abnormally high resistance."

621.396.822 **2168**

A Generalization of Nyquist's Thermal Noise Theorem.—Schremp. (*See* 2300.)

621.394/.397].645.3 + 621.392.5 **2169**

Network Analysis and Feedback Amplifier Design. [Book Review]—H. W. Bode. Van Nostrand Co., New York, 1945, 529 pp., $7.50. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, p. 277.) "The communication engineer whose mathematical foundation has been well laid and well used, will find this advanced text to be an authoritative and up-to-date contribution to the field of network-theory application."

GENERAL PHYSICS

517.947.44 : 534.25 **2170**

The Wave Equation in a Medium with a Variable Index of Refraction.—P. G. Bergmann. (*J. acoust. Soc. Amer.*, April 1946, Vol. 17, No. 4, pp. 329–333.) In the usual derivation of the wave equation for the sound pressure in air or in water no account is taken of the occurrence of density gradients. In this paper preliminary consideration is given to the conditions under which these gradients should be considered in the derivation of the wave equation itself.

523.165 + 537.591.15 **2171**

The Origin of Large Cosmic-Ray Bursts.—R. E. Lapp. (*Phys. Rev.*, 1st/15th April 1946, Vol. 69, Nos. 7/8, pp. 321–337.)

530.12 + 531.51 + 538.3 **2172**

A Classical Theory of Electromagnetism and Gravitation : Part 1—Special Theory.—H. C. Corben. (*Phys. Rev.*, 1st/15th March 1946, Vol. 69, Nos. 5/6, pp. 225–234.) A unified electromagnetic and gravitational field theory is obtained by introducing a fifth dimension ict' where t' is a second dimension of time symmetrical with t. The special theory (in which $\partial/\partial t' \equiv 0$) is presented here. The extended conservation laws for charge, mass, energy, momentum, and the fields of a point charge-mass are derived. An accelerated mass radiates longitudinal gravitational waves which are propagated with the velocity of light *in vacuo*, and the resultant energy loss may be observable in the case of large bodies. In matter, gravitational waves are slowed down, and are identified with sound waves.

531.4 + 539.62 **2173**

Studies in Friction : Part 1—"Solid" *versus* "Polar" Boundary Films.—M. E. Merchant. (*Phys. Rev.*, 1st/15th March 1946, Vol. 69, Nos. 5/6, pp. 250–251.) The friction between iron surfaces and the durability of the boundary film are very different according to whether carbon tetrachloride or oleic acid is added to pure mineral oil lubricant. Abstract of an Amer. Phys. Soc. paper.

536.2 : 546.87–1 **2174**

The Thermal Conductivity of Bismuth at Low Temperatures.—S. Shalyt. (*J. Phys., U.S.S.R.*, 1944, Vol. 8, No. 5, pp. 315–316.) Short description of measurements made with a cylindrical specimen of high purity set up in a suitable magnetic field. At 65–80° K the thermal resistance was increased 15–20% by the application of the field, but no detectable change was observed at 2–4° K. In the absence of the field the thermal resistance reached a minimum value in the region of 4° K. It is concluded that the minimum ". . . is chiefly due to the lattice".

537.122 : 538.3 **2175**

Classical Theory of the Point Electron.—M. Schönberg. (*Phys. Rev.*, 1st/15th March 1946, Vol. 69, Nos. 5/6, pp. 211–224.)

537.32 : 537.312.62 **2176**

On the Thermoelectric Phenomena in Superconductors.—V. L. Ginsburg. (*J. Phys., U.S.S.R.*, 1944, Vol. 8, No. 3, pp. 148–153.)

537.564 **2177**

On the Energy Loss of Fast Particles by Ionization.—L. Landau. (*J. Phys., U.S.S.R.*, 1944, Vol. 8, No. 4, pp. 201–205.) A theoretical development of a formula for the energy loss distribution for a fast particle which traverses a layer of matter and loses a small part of its energy through ionization, *i.e.*, a formula for the probability that the energy loss shall lie between given limits.

538.114 **2178**

On the Theory of Ferromagnetism.—B. T. Geylikman. (*J. Phys., U.S.S.R.*, 1944, Vol. 8, No. 3, pp. 182–191.) " On the basis of a translation model of the metal the temperature dependence of the magnetic moment at high and low temperatures has been found. At high temperatures the dependence obtained differs slightly from Heisenberg's formula, the Curie temperature, however, appears to depend on the degree of filling of the zone. The dependence of the conductivity of ferromagnetics on the temperature, which agrees with experiment, is also determined." An appendix gives a brief theoretical treatment of the fine structure of emission and absorption spectra from metals.

621.314.632 : 537.221 **2179**

Erratum : A Method for Measuring Effective Contact E.M.F. between a Metal and a Semi-Conductor.—W. E. Stephens, B. Serin & W. E. Myerhof. (*Phys. Rev.*, 1st/15th March 1946, Vol. 69, Nos. 5/6, p. 244.) Graph omitted from 1519 of June.

621.385 : 538.312 **2180**

Energy Conversion in Electronic Devices.—Gabor. (*See* 2394.)

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.165 + 537.591.15 **2181**

The Origin of Large Cosmic-Ray Bursts.—R. E. Lapp. (*Phys. Rev.*, 1st/15th April 1946, Vol. 69, Nos. 7/8, pp. 321–337.)

523.72 : 621.396.822 **2182**

Microwave Radiation from the Sun.—G. C. Southworth. (*J. Franklin Inst.*, March 1946, Vol. 241, No. 3.) Correction to 3252 of 1945.

523.746 **2183**

Sunspots.—A. L. Narayan. (*Curr. Sci.*, April 1946, Vol. 15, No. 4, pp. 95–98.) A general description of the structure and characteristics. The complex motion of the associated matter is discussed.

550.37 **2184**

Magnitude of the Earth's Charge.—A. B. Arlick. (*Curr. Sci.*, Dec. 1945, Vol. 14, No. 12, pp. 318–319.) In the light of modern theory, the value of Q is modified to 2.5×10^{14} coulombs instead of 4.5×10^{5} coulombs as previously assumed.

550.37 **2185**

Structure of the Earth's Electric Field.—A. B. Arlick. (*Curr. Sci.*, April 1946, Vol. 15, No. 4, pp. 105–106.) Certain anomalies in terrestrial magnetism and electricity are thought to be a natural consequence of the internal core, and of the existence of positive and negative ionic layers in the atmosphere.

550.37 **2186**

A Theory of the Fundamental Phenomena of Atmospheric Electricity.—J. Frenkel. (*J. Phys., U.S.S.R.*, 1944, Vol. 8, No. 5, pp. 285–304.) Attention is drawn to the application of the concepts of colloidal suspensions to the case of the atmosphere in which charged water drops and ice crystals are suspended. Laboratory measurements are considered in which a model of the atmosphere may be built using a suitable colloidal suspension.

In the atmosphere the cloud of charged drops becomes polarized due to the drops' sinking under gravitational force. The steady downward field within the cloud is in the range 30–150V/cm. The field in the space surrounding a spherical cloud is also calculated, and the numerical values agree fairly well with those measured in practice. " The clouds can thus be treated as electrical generators using the potential energy of the forces of gravity with a very small efficiency (of the order of 10^{-4}). . . The special conditions which are characteristic of thunder-clouds are elucidated (large vertical thickness and high water content), as well as the role of the increase of the negative local fields (giving rise to lightning discharges)." The mechanism by which the initial negative charge on the rain drops is neutralized (and sometimes reversed) during their passage to the ground is discussed.

551.51.053.5 : 523.78 **2187**

Ionosphere Observations [at Uppsala] **during the Solar Eclipse on September 10, 1942.**—W. Stoffregen. (*Ark. Mat. Astr. Fys.*, 20th Feb. 1946, Vol. 32, Part 4, Section B, No. 9, 6 pp. In English.) " The observations agree with earlier ones, and show a well marked ionization decrease of the F_2-region during the obscuration of the sun. The virtual height of the F_2-region increased parallel with the eclipse. No time difference of importance between the variation of the eclipse and the ionization was noted."

551.51.053.5 : 621.396.11 **2188**

On the Absorption of Radio Waves and the Number of Collisions in the Ionosphere.—Ginsburg. (*See* 2287.)

631.437 **2189**

On the Theory of Seismic and Seismoelectric Phenomena in a Moist Soil.—J. Frenkel. (*J. Phys., U.S.S.R.*, 1944, Vol. 8, No. 4, pp. 230–241.) The propagation of elastic waves in the surface layers of the soil is accompanied by the appearance of electric potential differences between points situated at different distances from the source. " According to the theory of Helmholtz and Smoluchovski, the difference of hydrostatic pressure Δp between two points of the soil must be connected with a difference of the electrical potential $\Delta V = \frac{\epsilon\zeta}{4\pi\mu\sigma}\Delta p$ where ζ is the electrokinetic potential, *i.e.* the potential drop in the surface double layer, μ — the viscosity of the water and σ — its electrical conductivity." The paper contains a very detailed theoretical analysis of the propagation of transverse and longitudinal waves in dry and moist soil, from which the electrical effects are derived in accordance with the above formula.

LOCATION AND AIDS TO NAVIGATION

621.396.11 : 551.51.053.5 : 621.396.9 **2190**

2-Mc/s Sky-Wave Transmission.—J. A. Pierce. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 146–153.) A simplified review of present ionospheric knowledge, with particular reference to Loran operations and the effect upon the sky-wave delay times of reflections at the E and F layers. It is shown that the E layer is relatively stable, is little affected by ordinary disturbing phenomena, and can be used for Loran operations at medium and long ranges.

621.396.9 **2191**

An Introduction to Loran.—J. A. Pierce. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, pp. 216–234.) The history and principles of the system are described. Within the groundwave service area (ranges up to 700 nautical miles over sea) errors vary from about 300 yards to 1 mile; at night, distances up to 1400 miles may be covered by sky waves, giving errors of 1½ to 8 miles.

The ultimate potential accuracy and the possibility of automatic position indicators and course followers are discussed, and mention is made of a new "cycle matching" technique which may considerably enhance the present accuracy of measurement.

The transmitting and receiving apparatus is broadly described, with block diagrams.

621.396.9 **2192**

The Decca Navigator.—(*Electronic Engng*, June 1946, Vol. 18, No. 220, pp. 166–171.) A detailed description of the system with a functional account of the equipment. See also 1848 of July and back reference.

621.396.9 **2193**

Shoran Precision Radar.—S. W. Seeley. (*Trans. Amer. Inst. elect. Engrs*, April 1946, Vol. 65, No. 4, pp. 232–240.) The system has been used extensively for air navigation, aerial mapping, and blind bombing. The aircraft transmits short pulses, at about 250 Mc/s, to a pair of spaced ground stations fitted with repeaters that receive, reshape, and retransmit the pulses. The time delay between the original transmission and the reception at the aircraft of the retransmitted pulses determines the position of the craft relative to the repeaters. There is no transmission between the ground stations. The history of the project, the method of use, and the main technical features of the system are described. The equipment is designated AN/APN-3 and AN/CPN-2. Useful range about 250 miles, accuracy about 50ft.

621.396.9 **2194**

Merchant Marine Radar.—I. F. Byrnes. (*RCA Rev.*, March 1946, Vol. 7, No. 1, pp. 54–66.) A survey of the essential requirements, based on the U.S. Coast Guard "Minimum Recommended Specification Briefs" and on a similar British document. It deals particularly with the so-called class-A type of radar, which operates in the 3-cm band, and is intended for navigation in restricted waters, with a receiver having a noise factor not worse than 15 db, and using a p.p.i. The importance of adequate power for operation under adverse conditions is emphasized.

621.396.9 **2195**

Radar Systems Considerations.—D. A. Quarles. (*Trans. Amer. Inst. elect. Engrs*, April 1946, Vol. 65, No. 4, pp. 209–215.) A technical background for the more detailed exposition of modern radar. A brief description is given of the nature and function of each major part of the system.

621.396.9 **2196**

Radar for Blind Bombing: Part 1.—J. V. Holdam, S. McGrath & A. D. Cole. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 138–143.) A description of the history and circuit details of H2X, the 3-cm radar system designed for use in aircraft as a navigational aid, and for the location and identification of ground targets obscured by cloud or smoke. The antenna, with a 29-inch modified paraboloid reflector, gives a beam width of 3°, can be rotated through 360° in azimuth, and tilted through ±20° in elevation. The echoes are displayed on an azimuth-stabilized p.p.i. presentation, with the aircraft heading shown as a radial line starting at the centre of the tube. An electronic bombing computer provides a range mark, the bombs being released when range mark and target coincide. For navigation, the system can be used in conjunction with radar responder beacons situated on the ground. When these beacons receive a pulse of the proper duration in the airborne search-radar frequency band, they respond with a coded series of pulses in the beacon frequency band. The subsequent display on the p.p.i. then gives the aircraft's position relative to a known point.

There are two versions of the equipment designated AN/APQ-13 and AN/APS-15.

621.396.9 : 523.3 **2197**

Radar Reaches the Moon.—T. Gootée. (*Radio News*, April 1946, Vol. 35, No. 4, pp. 25..88.) For a more detailed account see 1856 of July (Mofenson). For other brief accounts see J. DeWitt, *Radio Craft*, April 1946, Vol. 17, No. 7, pp. 464..502, and H. Kauffman, *QST*, May 1946, Vol. 30, No. 5, pp. 65–68.

621.396.9 : 621.385.832 **2198**

The Skiatron in Radar Displays.—King : Watson. (*See* 2404.)

621.396.933.2 **2199**

The Omnidirectional Range.—D. M. Stuart. (*Aero Digest*, 15th June 1945, Vol. 49, No. 6, pp. 76, 77, 150.) Outline description of the system. In the aircraft the azimuth of the ground station is determined from the phase of the received 60-c/s modulation, imposed at the ground by means of a continuously rotating goniometer on the carrier radiated from two pairs of cross-connected monopoles. Radiation from a central monopole is used for reference purposes.

621.396.933.2 **2200**

An Omnidirectional Radio-Range System: Part 3—Experimental Results and Methods of Use.—D. G. C. Luck. (*RCA Rev.*, March 1946, Vol. 7, No. 1, pp. 94–117.) For parts 1 & 2 see 458 and 2388 of 1942. Tests were made at about 6 and 125 Mc/s. Ground measurements showed overall instrumental errors averaging less than 1°, but

" flight tests . . . showed considerably larger errors, apparently related to terrain or transmitter-site characteristics. Sky-wave operation at the lower frequency was found fairly satisfactory in the absence of violent fading. Standing-wave effects were sought but not found in the ultra-high-frequency field. Trouble was experienced in the higher-frequency flight tests with spurious modulation of received signals produced by spinning propellers and imperfect structural bonding of aircraft, as well as with ignition interference."

621.396.9 **2201**
Radar. [Book Review]—O. E. Dunlap, Jr. Harper & Bros., New York, 1946, 203 pp., $2.50. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, p. 277.) " The text is well written, easily read, and up to date. . . . It is a valuable nontechnical contribution to inform the general public. . . ."

621.396.9 **2202**
Radar — Radiolocation Simply Explained. [Book Review]—R. W. Hallows. Chapman & Hall, London, 140 pp., 7s. 6d. (*Elect. Rev., Lond.*, 31st May 1946, Vol. 138, No. 3575, p. 848.) " . . . not highly technical, but contains a clear exposition of the basic principles. . . ."

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788 **2203**
A Reliable High Vacuum Gauge and Control System.—R. G. Picard, P. C. Smith & S. M. Zollers. (*Rev. sci. Instrum.*, April 1946, Vol. 17, No. 4. pp. 125–129.) The instrument incorporates two gauges, a thermocouple, and a cold-cathode discharge gauge, neither of which is damaged by the admission of air to the vacuum system. The useful range is from atmospheric pressure to about 10^{-4} mm Hg. The gauges are described, and a circuit is given whereby the gauge current can be used to operate other devices.

531.788.7 **2204**
An Ionization Gauge of Simple Construction.—C. M. Fogel. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, pp. 302–305.) For pressure range 10^{-4}–10^{-8} mm Hg. Advantages claimed include easy outgassing, good sensitivity, linear scale, small leakage current, and the fact that the filament is not damaged by heating it in air.

533.5 **2205**
A High Temperature Sodium Chloride to Glass Vacuum Seal for Infra-Red Cells.—G. L. Simard & J. Steger. (*Rev. sci. Instrum.*, April 1946, Vol. 17, No. 4, pp. 156–157.)

533.5 **2206**
A Rapidly Acting Vacuum Valve.—D. D'Eustachio. (*Phys. Rev.*, 1st/15th March 1946, Vol. 69, Nos. 5/6, p. 251.) Abstract of an Amer. Phys. Soc. paper.

535.37 : 661.1 : 546.791 **2207**
Polarization of Photoluminescence of Uranium Glasses.—A. N. Sevchenko. (*J. Phys., U.S.S.R.*, 1944, Vol. 8, No. 3, pp. 163–170.) An experimental investigation showing that the polarization depends markedly on the wavelength of the exciting radiation, and that the fine structure of the polarization spectra depends on the structure of the uranium molecules. The maximum polarization in the specimens examined was 25%. The polarization decreases with the decay of luminescence, showing that the " . . . energy of excitation is transmitted from the excited to the unexcited molecules. . . . It is proved that the nature of absorption and emission of radiation by uranium in glass and in solutions is due to electric dipoles."

537.228.1 + 539.32 + 621.3.011.5] : [546.32.85 + 546.39.85 **2208**
The Elastic, Piezoelectric, and Dielectric Constants of Potassium Dihydrogen Phosphate and Ammonium Dihydrogen Phosphate.—W. P. Mason. (*Phys. Rev.*, 1st/15th March 1946, Vol. 69, Nos. 5/6, pp. 173–194.) The full paper of which an abstract was summarized in 1260 of May.

539.234 : 535.87 : 546.621 **2209**
Numerical Data on the Optical Properties of Aluminized Mirrors.—L. Dunoyer. (*C.R. Acad. Sci., Paris*, 7th May 1945, Vol. 220, No. 19, pp. 686–688.) Mirrors were prepared by condensation in a vacuum, and the transmission and reflection factors measured for the metallized and unmetallized sides. The same factors are derived for the metal layer alone in air and in glass. A table shows these data for metal thicknesses from 7.5 to 80.9 mμ. For other measurements on the mirrors see 2210/2212 below.

539.234 : 535.87 : 546.621 **2210**
On the Optical Density of Thin Films of Aluminium Deposited on Glass by Evaporation and the Thickness of the Protective Alumina Layer.—L. Dunoyer. (*C.R. Acad. Sci., Paris*, 4th June 1945, Vol. 220, No. 23, pp. 816–817.) The curve of optical density against film thickness (determined by weight) has a sharp bend for a thickness of 10.8 mμ which, together with previous evidence, suggests a change in layer structure for a thickness of about 11 mμ. Extrapolation indicates zero optical density for a film thickness of 5.4 mμ. This is explained as due to oxidation of an actual thickness of 2.9 mμ of metallic aluminium. Correction for the oxide layer converts the figure for the critical thickness from 11 mμ to 8.5 mμ.

The absorption and extinction coefficients are calculated.

539.234 : 546.621 **2211**
On the Diffusion of Atoms or Molecules by a Glass Wall.—L. Dunoyer. (*C.R. Acad. Sci., Paris*, 9th April 1945, Vol. 220, No. 15, pp. 520–522.) A film of aluminium deposited on glass by condensation at oblique incidence in a vacuum was found to vary in thickness with distance from the emitting source at a rate that changed abruptly at the place where the thickness was about 11 mμ. It is suggested that the crystallites in films of greater thickness are sufficiently close to ensure the capture of each incident atom by the field of the nearest crystal lattice, whereas for thinner films an appreciable fraction of the incident atoms do not adhere, but are diffused away from the glass. It is considered unlikely that the discontinuity in the rate of change of density of the film is associated with the difference in angle of incidence of the particles.

539.234 : 621.316.849.011.2 : 546.621 **2212**
Electrical Resistance of Thin Films of Aluminium Deposited on Glass by Thermal Evaporation.—L. Dunoyer. (*C.R. Acad. Sci., Paris*, 25th June

1945, Vol. 220, No. 26, pp. 907–909.) The resistivity of the metal film increases as the thickness is reduced. The ratio of film resistivity to bulk resistivity is about 2 for thicknesses near 100 $m\mu$ (corrected for the oxide layer), 9.4 for 7.2 $m\mu$, 119 for 3.3 $m\mu$, 860 for 1.9 $m\mu$ and ∞ for 0.9 $m\mu$, corresponding to a layer about two atoms thick. Figures are given for 19 different thicknesses.

539.32.082 **2213**

Elastic Constants of Crystals.—S. Bhagavantam. (*Sci. Culture*, April 1946, Vol. 11, No. 10, Suppt. p. 3.) Abstract of an address delivered at the Indian Science Congress, describing a new method of measuring the elastic constants of materials in the form of small plates.

546.287 : 621.315.612 **2214**

The Use of Liquid Dimethylsilicones to produce Water-Repellent Surfaces on Glass-Insulator Bodies.—O. K. Johannson & J. J. Torok. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, pp. 296–302.) The article to be treated is thoroughly cleaned and dipped in a dilute solution of the silicone in an inert solvent, The solvent is allowed to evaporate, and the article is then baked to fix the film on the surface. The routine is described.

Numerical and graphical results given in terms of surface resistance and power factor show that this finish is superior both to the untreated surface and to wax-dipped surfaces. The overall power factor in the dry state is not affected by the finish. The silicone does not affect the resistance to fungus growth.

546.287 : 621.315.616.9 : 621.316.842 **2215**

Silicone Coating for [wire-wound] **Resistors.**—E. E. Marbaker. (*Radio, N.Y.*, Feb. 1946, Vol. 30, No. 2, p. 10.) Withstands repeated 275° C thermal shocks and repeated immersion in hot and cold salt water without cracking, crazing, or peeling, and has good dielectric strength. Summary of a paper in *J. Amer. Ceramic Soc.*, 1st Dec. 1945.

546.289 : [621.315.59 + 621.314.63 + 537.32 **2216**

Germanium Alloys.—(*Phys. Rev.*, 1st/15th March 1946, Vol. 69, Nos. 5/6, pp. 258–259.) Abstracts are given of the following Amer. Phys. Soc. papers: Electrical Properties of Germanium Alloys: Part 1—Electrical Conductivity and Hall Effect, by K. Lark-Horovitz, A. E. Middleton, E. P. Miller & I. Walerstein. Electrical Properties of Germanium Alloys: Part 2—Thermoelectric Power, by K. Lark-Horovitz, A. E. Middleton, E. P. Miller, W. W. Scanlon & I. Walerstein. Theory of Impurity Scattering in Semiconductors, by E. Conwell & V. F. Weisskopf. Theory of Resistivity in Germanium Alloys, by K. Lark-Horovitz & V. A. Johnson. Theory of Thermoelectric Power in Germanium, by V. A. Johnson & K. Lark-Horovitz.

621.314.63 + 621.315.59 **2217**

Heat Treatment of Semi-Conductors and Contact Rectification.—B. Serin. (*Phys. Rev.*, 1st/15th April 1946, Vol. 69, Nos. 7/8, pp. 357–362.) The influence of heating silicon to about 1 000° C probably causes evaporation of the impurities, and an analysis of this process is given which suggests that a surface layer of at least 10^{-6} cm thickness is depleted. The characteristics of a rectifier so formed are given following Bethe's theory, and it is concluded that heat treatment results in increased back resistance and decreased contact capacity, with improvement in rectification efficiency.

621.315.59 **2218**

On the Theory of Electric Properties of Good Conducting Semi-Conductors.—K. Shifrin. (*J. Phys., U.S.S.R.*, 1944, Vol. 8, No. 4, pp. 242–252.) A theoretical and experimental study of the properties of substances such as lead sulphide and lead selenide, which have relatively high conductivities (of the order of 100 or even 1 000 mhos/cm), and which differ from ordinary semiconductors in the sign of the temperature coefficients of conductivity and thermo-e.m.f. It appears that these distinctive properties are caused by the presence of atoms of impurity metals.

621.315.612.6 : 621.315.613.1 **2219**

Manufacture and Use of Glass Bonded Mica.—D. E. Replogle. (*Electronic Industr.*, April 1946, Vol. 5, No. 4, pp. 94–96.) A general survey of its properties and of its advantages over other synthetic insulators. It may be machined or moulded with greater ease and accuracy than steatite, has good electrical properties, does not require sealing, and will not support fungus growth.

621.315.615 : 621.319.4 : 621.365.5 **2220**

Capacitors for High-Frequency Induction-Heating Circuits.—F. M. Clark & M. E. Scoville. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1945, Vol. 64, pp. 995–996.) Discussion of 636 of March.

621.315.616.7 **2221**

Sulfur in Synthetic Rubbers.—F. S. Malm. (*Bell Lab. Rec.*, March 1946, Vol. 24, No. 3, pp. 106–110.) A short study of the solubility and diffusion rates of sulphur in the process of vulcanization.

621.315.616.9 **2222**

The Development of Polythene as a High-Frequency Dielectric.—W. Jackson & J. S. A. Forsyth. (*J. Instn elect. Engrs*, Part I, May 1945, Vol. 92, No. 53, p. 214.) Summary of 2768 of 1945.

621.318.32 : 621.318.42 **2223**

Ferroinductance as a Variable Electric-Circuit Element.—J. D. Ryder. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1945, Vol. 64, pp. 962–963.) Discussion of 643 of March.

621.318.32.013 : 539.3 **2224**

Magnetization and Stress.—R. M. Bozorth. (*Bell Lab. Rec.*, March 1946, Vol. 24, No. 3, pp. 116–119.) A short account, illustrated by curves for iron, nickel, and 68 Permalloy, of the effect of mechanical stress on ferromagnetic properties.

621.318.322 : [621.314.2.029.4/.5 **2225**

Applications of Thin Permalloy Tape in Wide-Band Telephone and Pulse Transformers.—A. G. Ganz. (*Trans. Amer. Inst. elect. Engrs*, April 1946, Vol. 65, No. 4, pp. 177–183.) An account of construction and properties, illustrated by graphs, and of applications to both transformers and non-linear inductors.

621.357.9 **2226**

Remarks on the Mechanism of Electrolytic Polishing and on Its Unevenness in the Case where there exists a Viscous Anodic Layer.—C. Gutton. (*C.R. Acad. Sci., Paris*, 7th May 1945, Vol. 220, No. 19, pp. 684–686.)

621.396.611.21 **2227**

Plating Quartz Oscillator Crystals.—K. M. Laing. (*Communications*, April 1946, Vol. 26, No. 4, pp. 26–28, 56.) An analysis of plating methods.

621.396.611.21 : 537.531.9 **2228**

Quartz Oscillator Plates. Frequency Adjustment by X-Ray Irradiation.—L. A. Thomas. (*Beama J.*, April 1946, Vol. 53, No. 106, p. 144.) Describes changes in colour and in elastic properties when exposed to X-rays. Abstract of a paper in *Elect. Times*, 7th March 1946, Vol. 109, No. 2837, pp. 336–340.

621.396.69 **2229**

Printed Electric-Circuit Process.—(*Communications*, April 1946, Vol. 26, No. 4, pp. 78, 79.) See also 1887 of July (Brunetti & Khouri), and *Electronic Industr.*, April 1946, Vol. 5, No. 4, pp. 90.. 120.

621.791.3 : 621.315.351 **2230**

Destructive Effect of High Temperature Solders on Copper Wire.—R. H. Bailey. (*Wire & W. Prod.*, March 1945, Vol. 20, No. 3, pp. 197–199.) The influence of temperature, wire size, and tin content of the solder is discussed and illustrated by graphs, and the detrimental effect on wire life of high soldering temperatures and high tin content emphasized. It is recommended that fine wires should be soldered at temperatures below 600°F.

66.002.3 (03) **2231**

Encyclopedia of Substitutes and Synthetics. [Book Review]—M. D. Schoengold (Ed.). Philosophical Library, New York, 1943, 360 pp., $10.00. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, p. 280.)

666.1/.2 **2232**

The Elements of Glass Technology for Scientific Glass Blowers (Lampworkers). [Book Review]—W. E. S. Turner. The Glass Delegacy of the Univ. of Sheffield, Sheffield, 1945, 29 pp. (*Rev. sci. Instrum.*, April 1946, Vol. 17, No. 4, p. 147.) " . . . a very compact and concise summary of the fundamental properties of glass which are concerned in such working."

679.5 **2233**

Plastics : Scientific and Technological. [Book Review]—H. R. Fleck. English Univ. Press, London, 25s. (*Engineer, Lond.*, 29th March 1946, Vol. 181, No. 4707, p. 294.) "Instructive and comprehensive treatise which will be of considerable value to all connected with the application of plastics in industry." Contains a survey of literature.

MATHEMATICS

518.5 **2234**

A New Type of Differential Analyzer.—V. Bush & S. H. Caldwell. (*J. Franklin Inst.*, March 1946, Vol. 241, No. 3.) Correction to 361 of February.

621.396.67 **2235**

Concerning Hallén's Integral Equation for Cylindrical Antennas.—Schelkunoff : King. (*See* 2141.)

51 : 62 **2236**

Engineering Mathematics. [Book Review]—H. Sohon. D. Van Nostrand Co., New York, 1944, 278 pp., $3.50. (*Rev. sci. Instrum.*, April 1946, Vol. 17, No. 4, pp. 142–143.)

518.2 **2237**

Tables of Functions with Formulae and Curves. [Book Review]—E. Jahnke & F. Emde. Dover Publications, New York, 306 pp., 22s. 6d. (*Beama J.*, April 1946, Vol. 53, No. 106, p. 138.) An enlarged and new edition (subsequent to the 1938 edition).

MEASUREMENTS AND TEST GEAR

621.3.083.7 : 629.13 **2238**

Electronic Recorder Aids Flight Research.—T. A. Dickinson. (*Aero Digest*, 15th April 1945, Vol. 49, No. 2, pp. 76..200.) General description of an 80-channel telemetering system for transmitting data from aircraft instruments to a pen-recorder assembly on the ground.

621.3.087.5 **2239**

Colored Trace Oscillograms.—L. S. Trimble & F. W. Bowden. (*J. Soc. Mot. Pict. Engrs*, March 1946, Vol. 46, No. 3, pp. 231–236.) A colour-sensitive photo-recording material has been used for the simultaneous recording of several electrical impulses. This allows the reproduction of interweaving traces in separate and distinct colours. A 5½-inch-wide film in combination with filtered light beams has given recording speeds up to 20 inches per sec.

621.317 : 621.396.61 **2240**

Resonant-Cavity Measurements.—R. L. Sproull & E. G. Linder. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, pp. 305–312.) Methods of measuring the resonant frequency, *Q*, and shunt resistance of resonant cavities in the wavelength range 2–12 cm are described. An f.m. oscillator is used with probe injection to the cavity under test. A similar probe is used with a crystal detector, of which the output is amplified and applied to the Y plates of a c.r.o. The 60-c/s timebase on the X plates controls the modulator of the oscillator so that a stationary "response" curve of the cavity is obtained. The procedure is described for using this apparatus for measuring the resonant frequency in terms of that of a cavity-resonator wavemeter, and for measuring the *Q*. The shunt impedance is derived from measurements of *Q* or resonant frequency before and after the insertion of a rod of lossy dielectric into the resonator.

621.317.1 : [621.315.21.029.5/.6 **2241**

Testing of R.F. Cables.—(*See* 2130.)

621.317.341.029.58/.62] : 621.315.212 **2242**

The S-Function Method of Measuring Attenuation of Coaxial Radio-Frequency Cable.—C. Stewart, Jr. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1945, Vol. 64, p. 966.) Discussion of 666 of March.

621.317.35 + 621.3.018.7 **2243**

Television Waveforms.—(*See* 2359.)

621.317.35 **2244**

Complex Waveforms : The Harmonic Synthesiser (Cont.)—Wave Analysis.—H. Moss. (*Electronic Engng*, June 1946, Vol. 18, No. 220, pp. 179–182.) A description, with illustrations, of wave analysis by superposition methods when only 2 or 3 wave components are present, and by the envelope method for high frequency ratios and beats. Continuation of 1917 of July. Part 5 of a series on c.r.t. traces.

621.317.36 **2245**

Recent Advances in the Measurement of Frequency.—L. Essen. (*R.S.G.B. Bull.*, May & June 1946, Vol. 21, Nos. 11 & 12, pp. 166 . . 172 & 182–184.) General historical description of developments in standard-frequency oscillators, heterodyne frequency meters, and absorption wavemeters, for use up to 10 000 Mc/s.

621.317.36 : 621.396.712 **2246**

The Measurement of Broadcast Station Frequencies.—J. Hers. (*Trans. S. Afr. Inst. elect. Engrs*, Feb. 1946, Vol. 37, No. 2, pp. 35–55.) The different methods of checking transmitter frequencies are reviewed. "The paper discusses various kinds of frequency standards, the generation of standard harmonic series, and their use in measurement. Various kinds of measuring equipment are described, with particular reference to the equipment built by the South African Broadcasting Corporation."

621.317.42 **2247**

A B-H Curve Tracer for Magnetic-Recording Wire.—T. H. Long & G. D. McMullen. (*Trans. Amer. Inst. elect. Engrs*, March 1946, Vol. 65, No. 3, pp. 146–149.) "The equipment described is able to show on the screen of an oscilloscope the cyclic hysteresis loop of a sample of magnetic-recording wire a little over one inch long and 0.004 inch in diameter. Results obtained with the equipment in studying recording wires are given." The magnetic properties are influenced by the tension of the wire, and this magnetostrictive characteristic might be used to give an instantaneous measure of wire tension.

621.317.7.089.6 : 621.396.823 **2248**

A Study of Wave Shapes for Radio-Noise-Meter Calibrations.—C. W. Frick. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1945, Vol. 64, pp. 890–901.) An account of a theoretical and experimental investigation to secure better agreement between meters used for assessing continuous impulsive interference with radio receivers, such as that caused by motors or gas-discharge tubes. The use of a signal of standard waveform is advocated for calibrating noise meters, and a method of evaluating the noise-producing effect of such signals is developed. It is shown that a 60-c/s substantially square wave, in which 63% of the voltage change from peak to peak takes place exponentially in 0.075 μs ± 20% is a useful calibrating signal that gives material improvement in the agreement between noise measurements made with actual radio receivers and with noise meters.

621.317.714+621.317.727] .087.64 **2249**

Electronically Balanced Recorder for Flight Testing and Spectroscopy.—A. J. Williams, Jr., W. R. Clark & R. E. Tarpley. (*Trans. Amer. Inst. elect. Engrs*, April 1946, Vol. 65, No. 4, pp. 205–208.) Description of the circuit and performance of a multipoint potentiometer recorder for thermocouples. The out-of-balance current is interrupted by a vibrator and amplified to drive a synchronous motor that drives the slide-wire contact and recorder. Adaptation for current (instead of e.m.f.) and current-ratio recording is described.

621.317.72.029.5/.62 **2250**

A Remote-Indicating Field-Strength Meter.—E. P. Tilton. (*QST*, May 1946, Vol. 30, No. 5, pp. 21 . . 152.) Practical details of two simple units, one containing switched coils for 28, 50, and 144 Mc/s, a crystal rectifier and rod aerial, and the other housing a microammeter for reading the crystal current. The units are connected by a cable for remote measurements while adjusting the transmitter under test.

621.317.725.015.532 **2251**

A Corona Voltmeter.—Widmer. (*See* 2130.)

621.317.76.029.54/.58 **2252**

A Precision Frequency Standard.—M. Saxon. (*Radio News*, April 1946, Vol. 35, No. 4, pp. 36 . . 131.) Details of an amateur version of the U.S. Army's BC-211 oscillating frequency meter, range 630–11 000 kc/s with a gap 1 040–1 260 kc/s. A crystal oscillator provides check points. Accuracy, a few parts in 10^5.

621.317.79 : 621.395.8 **2253**

The Measurement of Audio Distortion.—H. H. Scott. (*Communications*, April 1946, Vol. 26, No. 4, pp. 23 . . 56.) A study of methods used to measure nonlinear, amplitude, or harmonic distortion. The measuring instruments include distortion meters, wave analyser, and intermodulation meter. Procedures used for measurement of distortion in a.m. and f.m. systems are also discussed.

621.317.79 : 621.396.615.14 : 621.396.619.018.41 **2254**

High Frequency F.M. Signal Generator.—(*Electronic Industr.*, April 1946, Vol. 5, No. 4, pp. 86–87.) General description of an instrument for laboratory and production testing of f.m. receivers over the range 86–108 Mc/s. The instrument has low distortion, and a maximum deviation of ± 300 kc/s. The Colpitts oscillator is modulated by two reactance valves, and the signal output is obtained from an H_{11}-mode piston attenuator calibrated directly in microvolts from 1 to 10^5.

621.317.79 : 621.397.62 **2255**

A Television Signal Generator : Part 1—General Features.—R. G. Hibberd. (*Electronic Engng*, June 1946, Vol. 18, No. 220, pp. 174–175, 178.) The generator is designed to give signals within the specification of the B.B.C. transmissions, for testing receivers. Vision modulation is derived from a monoscope (see 2865 of 1938—Burnett), which is briefly described, and synchronizing pulses are provided by a special impulse generator. A block diagram is given, and the display and monitoring equipment is briefly described.

621.317.79 : 621.396.82 **2256**

Cylindrical Shielding and Its Measurement at Radio Frequencies.—Anderson. (*See* 2167.)

53.08 **2257**

Scientific Instruments. [Book Review]—H. J. Cooper (Ed.). Hutchinson's Scientific & Technical Publications, London, 293 pp., 25s. (*Elect. Rev., Lond.*, 31st May 1946, Vol. 138, No. 3575, p. 848.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

621.3.078 : 621.791.76 **2258**

Electronic Controls for Resistance Welding.—H. L. Horton. (*Machinery, N.Y.*, Oct. 1944, Vol. 51, No. 2, pp. 153–159.) A survey of methods of controlling the heat generated and of timing control, and their application to various types of industrial equipment. Part 3 of a series. For other parts see 2273, 2259, 2269 and 2263.

621.3.078 : 621.9 **2259**

Electronic Control and Regulation of Motor Drives.—H. L. Horton. (*Machinery, N.Y.*, June 1944, Vol. 50, No. 10, pp. 165–172.) Control (*i.e.*, arbitrary adjustment by external influence) is distinguished from regulation (*i.e.*, self-correction by feedback of the deviation from a standard). An account of the principles and their application to typical practical problems of machine-tool practice. Part 2 of a series. For other parts see 2273, 2258, 2269 and 2263.

621.317.39 : 531.717 : 667.613 **2260**

Instrument for Measuring Thickness of Nonconducting Films Applied over Nonmagnetic Metals.—A. L. Alexander, P. King & J. E. Dinger. (*Industr. Engng Chem.* (*Analyt. Edit.*), June 1945, Vol 17, No. 6, pp. 389–393.) The inductance coil, 1 inch in diameter, of an oscillator with a frequency of 5 kc/s or more, is placed first on an uncoated metal surface, and then on a similar surface that has been coated ; the difference in oscillator frequency in the two cases, determined by a heterodyne method, is a measure of the coating thickness. The tuning capacitor of the oscillator, adjusted to bring the frequency always to that of a constant reference oscillator, can be calibrated in film thickness for different film substances. The device is simple and suitable for routine measurements in the range 0–0.025 inch, with an accuracy better than 0.001 inch. Measurements must be made on a flat surface not less than 2 inches in diameter in order to obtain freedom from edge effect.

Complete circuit diagrams are given.

621.317.39 : 531.76 **2261**

Electronic Chronoscope for Measuring Velocities of Detonation of Explosives.—C. R. Nisewanger & F. W. Brown. (*U.S. Bureau of Mines Rept of Investigations*, March 1946, R.I. 3879, 18 pp.) An instrument for measuring the time of travel (of the order of microseconds) of an explosion in a short length of material. The novel method used employs the voltage-time characteristics of an RC circuit, with thyratrons to give the switching action at the beginning and end of the time interval measured. The explosion can either be used to bridge two separated wires by the ionization it produces (" make " system), or to fuse a continuous wire (" break " system). A d.c. valve-voltmeter is used to indicate the charge on the capacitor of the RC circuit, and a meter reading nearly proportional to the time interval is obtained ; there are five ranges with full-scale times from 5 to 150 μs. The instrument is mains-operated, with voltage-regulator tubes to ensure stability of calibration. An internal test circuit generating a pulse about 2 μs in length is incorporated. The method of operation is described in detail, and further improvements are suggested. A table of typical velocity measurements is given.

621.317.39 : 620.172.222 **2262**

Resistance Wire Strain Gage Applications and Circuits.—E. G. Van Leeuwen & W. F. Gunning. (*Prod. Engng*, July 1945, Vol. 16, No. 7, pp. 443-449.) The construction, mounting operations, and associated electrical circuits are described, together with applications to the measurement of various types of strain.

621.317.39 : 621 **2263**

Electronic Measurement, Analysis, and Inspection : Parts 1 & 2.—H. L. Horton. (*Machinery, N.Y.*, June & Aug. 1945, Vol. 51, Nos. 10 & 12, pp. 157–161 & 168–173.) A review of photocell applications, temperature regulation, metallurgical analysis with a cathode-ray tube, X-ray examination of materials, devices for measuring small mechanical irregularities and displacements, and the electron microscope. Parts 5 and 6 of a series. For other parts see 2273, 2259, 2258 and 2269.

621.317.39.083.7 : 531.74 : 621.396.663 **2264**

Improvements in Devices for the Instantaneous Transmission of Angles.—R. Barthélemy. (*Génie civ.*, 15th Feb. 1946, Vol 123, No. 4, p. 52, *C. R. Acad. Sci., Paris*, 29th Oct. 1945, Vol. 221, No. 18, pp. 487–489.) Alternating current in the moving coil of a goniometer coil system induces currents in the stators proportional to the sine and cosine of the angle of the rotor. The currents from the stators are respectively passed through the rotor coils of two other goniometers of which the rotors are on a common spindle and bear the same angle to their respective stators. These four stators are connected in series in pairs, the X-coil of one with the Y-coil of the other. The outputs from the two pairs of stators are applied with or without amplification to the deflector plates of a c.r. tube, and set the trace at an angle that is the sum of the angle of setting of the first goniometer and the common angle of setting of the other two. Further pairs of coupled goniometers can be added so that the output of the system defines an angle that is the sum of the angles of setting of each spindle. The systems can also be used to operate servomechanisms instead of a c.r. display.

621.317.39.083.7 : 532.593.082 **2265**

Measurement of Ocean Waves Generated by Atomic Bombs.—N. J. Holter. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 94–98.) A general description of the following equipment : underwater recording echo-sounders, self-contained wave-pressure recorders, shore-connected wave-pressure recorders, radio-synchronized cameras, recording television, maximum-water-height recording transmitters, and water level recorders.

621.317.755 : 545.822 **2266**

Spectrochemical Analysis with the Oscillograph.—G. H. Dieke & H. M. Crosswhite. (*J. opt. Soc. Amer.*, April 1946, Vol. 36, No. 4, pp. 192–195.)

621.317.755 : 621.43 **2267**

Ignition Testing Unit.—(*Flight*, 12th July 1945, Vol. 48, No. 1907, pp. 47–48.) Description of a cathode-ray equipment that displays the ignition pulses derived from the p.d. at the magneto switch or ignition coil. Faults are detected by abnormalities in waveform. Circuit details are not given.

621.365.5 + 621.365.9 + 621.396 **2268**

Discussion on "The Place of Radiant, Dielectric and Eddy-Current Heating in the Process Heating Field".—L. J. C. Connell, O. W. Humphreys & J. L. Rycroft. (*J. Instn elect. Engrs*, Part II, Feb. 1946, Vol. 93, No. 31, pp. 48–50.) For original paper see 145 of January.

621.365.5 + 621.365.92 **2269**

Electronic Heating of Metals and Non-Metallic Materials.—H. L. Horton. (*Machinery, N.Y.*, March 1945, Vol. 51, No. 7, pp. 146–155.) A review of the principles and mechanical-engineering applications of induction and dielectric heating. Part 4 of a series. For other parts see 2273, 2259, 2258 and 2263.

621.365.52 **2270**

Measurement of the Form Factor in Induction Ovens without Magnetic Core.—G. Ribaud & M. Leblanc. (*C.R. Acad. Sci., Paris*, 23rd May 1945, Vol. 220, No. 21, pp. 732–733.) A table of values is given for a number of useful forms. See also 3821 of 1944.

621.365.52 **2271**

Design of Induction-Heating Coils for Cylindrical Non-Magnetic Loads.—J. T. Vaughan & J. W. Williamson. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1945, Vol. 64, pp. 965–966.) Discussion of 148 of January.

621.365.92 : 674.23 **2272**

Electronic Heating in the Furniture Industry.—E. S. Winlund. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 108–113.) A review of the principles of generating the power for dielectric heating, transferring it to the load, and shaping the electrodes to concentrate the heat where it is required. Several examples are given of its application to the setting of the bonding-glues used in assembling joints, and in producing plywood and veneered furniture. The efficient use of dielectric heating can effect a considerable saving in production costs.

621.38 : 621 **2273**

Electronics for the Machine Designer.—G. A. Caldwell & C. Madsen. (*Machinery, N.Y.*, May 1944, Vol. 50, No. 9, pp. 135–150.) A review of the fundamentals of electronics and of the features which make electronic devices potentially useful for application in the mechanical field. The first of a 6-part series. For other parts see 2259, 2258, 2269 and 2263.

621.383 + 621.317.755] : 535.243 **2274**

Spectral Intensity Measurements with Phototubes and the Oscillograph.—G. H. Dieke, H. Y. Loh & H. M. Crosswhite. (*J. opt. Soc. Amer.*, April 1946, Vol. 36, No. 4, pp. 185–191.)

621.383 : 536.52 : 621.317.39 **2275**

Color Temperature Testing in Projector Lamp Production.—S. Pakswer & J. Kirk. (*Rev. sci. Instrum.*, April 1946, Vol. 17, No. 4, pp. 157–158.) Phototubes measure the blue and red radiations from the lamp, and their ratio (giving the temperature of the lamp) is displayed on a c.r.t.

621.385.833 **2276**

On a Photographic Method for Investigating the Optical Properties of Magnetic Lenses and for Recording β-Ray Lines.—H. Slätis. (*Ark. Mat. Astr. Fys.*, 20th Feb. 1946, Vol. 32, Part 4, Section A, No. 20, 27 pp. In English.)

621.396.611 : 621.384 **2277**

On the Design of a Cavity of a Linear Electron Accelerator.—E. S. Akeley. (*Phys. Rev.*, 1st/15th March 1946, Vol. 69, Nos. 5/6, p. 255.) Abstract of an Amer. Phys. Soc. paper.

621.396.9 : 359 **2278**

Navy Radio and Electronics during World War II.—J. B. Dow. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, pp. 284–287.) A non-technical review of some of the electronic devices used by the U.S. Navy emphasizing their importance in naval tactics. Extracts from action reports illustrate the use of radar fire control and of sonar (see 1750 of July) against submarines.

621.396.9 : 623.454.25 **2279**

The Application of Radar to Ballistics: the Radar Shell-Fuse.—M.A. (*Génie civ.*, 1st March 1946, Vol. 123, No. 5, p. 63.) See also 1627 of June (Selvidge) and 624 of March (Huntoon & Miller).

621.396.91.083.7 **2280**

Radiosonde Telemetering Systems.—V.D.Hauck, J. R. Cosby & A. B. Dember. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 120–123.) A description of equipment used by the U.S. Army and Navy, designated AN/AMQ-1D, and by the Weather Bureau, designated 506-WB. It is essentially a development of the Diamond and Hinman apparatus (see 2682 of 1938 and 58 of 1939). A temperature-compensated aneroid unit operates a multi-contact switch connected to temperature- and humidity-sensitive resistors that control, in turn, the quench frequency of the transmitter. Batteries with lead and lead-dioxide plates are used, with perchloric acid as the electrolyte. Accuracy: pressure, 5 millibars in the range 10-1 060 mb and +60 to −90°C; temperature, 1°C.

621.38 : 62 **2281**

Electronic Equipment and Accessories. [Book Review]—R. C. Walker. Chemical Pub. Co., Brooklyn, N.Y., 1945, 239 pp., $6.00. (*Rev. sci. Instrum.*, April 1946, Vol. 17, No. 4, p. 141.) "..can be recommended as a 'first course' in electronic instrumentation as well as a compendium of information on electronic and associated devices."

PROPAGATION OF WAVES.

621.396.11 + 621.396.67 **2282**

A Note on a Simple Transmission Formula.—H. T. Friis. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, pp. 254–256.) A formula relating the received and transmitted powers at the aerial terminals, P_r and P_t, in terms of the effective areas A_r and A_t of the aerials, their distance apart d, and the wavelength λ, is derived in the form

$$\frac{P_r}{P_t} = \frac{A_r A_t}{d^2 \lambda^2}$$

The meaning to be ascribed to the effective area is discussed, and its value given for certain special cases. The formula applies to free-space transmission only, and should not be used when d is small, because the assumption of a plane wave-front is then not justified.

621.396.11 **2283**

Propagation of Radiation in a Medium with Random Inhomogeneities.—P. G. Bergmann. (*Phys. Rev.*, 1st/15th March 1946, Vol. 69, Nos. 5/6, pp. 255–256.) The use of ray optics shows that fluctuations of a radiative field are related to variations in refractive index, and increase with the 3/2-power of distance. Abstract of an Amer. Phys. Soc. paper.

621.396.11 : 523.746.5 **2284**

DX and the Present Sunspot Cycle — A Prophecy.—E. H. P. Young. (*R.S.G.B. Bull.*, May 1946, Vol. 21, No. 11, p. 170.) Discussion of 324 of February (Gleissberg).

621.396.11 : 551.51.053.5 **2285**

Radio Propagation Work at the National Bureau of Standards.—N. Smith & R. Silberstein. (*QST*, May 1946, Vol. 30, No. 5, pp. 45–50.) An account of the progress made in forecasting transmission conditions. Maximum usable frequencies and lowest useful high frequencies can now be predicted accurately from measurements of the properties of the ionosphere made at vertical incidence. A map shows the world-wide distribution of observing stations in January 1946.

621.396.11 : 551.51.053.5 **2286**

Irregularities in Radio Transmission.—O. P. Ferrell. (*Radio, N.Y.*, Feb. 1946, Vol 30, No. 2, pp. 23–24.) A survey of sporadic-*E* propagation at v.h.f., and of the effect on f.m. transmission. A bibliography with abstracts is included. For previous parts of this 3-part series see 1333 of May and 1640 of June.

621.396.11 : 551.51.053.5 **2287**

On the Absorption of Radio Waves and the Number of Collisions in the Ionosphere.—V. Ginsburg. (*J. Phys., U.S.S.R.*, 1944, Vol. 8, No. 4, pp. 253–256.) "The measurement of the absorption of radio waves in the ionosphere enables one to determine the effective number of collisions in some of its regions. On the other hand, it is possible with the help of the usual method of kinetic equation to evaluate the number of collisions effective for the process of absorption of radio waves. Both the electrons' collisions with the molecules and their collisions with the ions can be thus calculated. The cross section for the latter process under conditions prevailing in the ionosphere is about a million times larger than for collisions with the molecules. In this connexion the concentration of ions and molecules in the ionosphere, as derived from radio measurements, is discussed."

621.396.11 : 551.51.053.5 : 621.396.9 **2288**

2-Mc/s Sky-Wave Transmission.—Pierce. (*See* 2190.)

621.396.13 : 621.397 **2289**

Vertical *v.* Horizontal Polarisation.—H. P. Williams. (*J. Televis. Soc.*, Sept. 1945, Vol. 4, No. 7, pp. 171–177.) A consideration of the relative merits for television transmission, with particular reference to the effect of ground reflection and aerial height. It is concluded that there is no distinct advantage in either mode, but "such differences as do exist are mostly in favour of horizontal polarization".

621.396.812.3 : 551.51.053.5 **2290**

On Some Observations of Fading of Short-Wave Signals.—S. S. Banerjee & G. C. Mukerjee. (*Sci. Culture*, April 1946, Vol. 11, No. 10, pp. 571–575.) Quasi-regular variations in the intensity of short-wave radio signals reflected from the ionosphere are interpreted as due to interference between multiple reflections.

RECEPTION

621.396.619.018.41 : 621.396.82 **2291**

Larger F.M. Carrier Suppresses Smaller.—H. G. Shea. (*Electronic Industr.*, April 1946, Vol. 5, No. 4, pp. 78–79.) A simple explanation with vector diagram illustrations.

621.396.621 **2292**

32-Volt [broadcast] **Receiver.**—L. Treakle. (*Radio Craft*, April 1946, Vol. 17, No. 7, pp. 466..516.) Constructional details.

621.396.621 **2293**

Radio Data Sheet 334.—(*Radio Craft*, April 1946, Vol 17, No. 7, p. 475.) Servicing data for Farnsworth broadcast receivers.

621.396.621(43) **2294**

Five New Circuits.—R. M. Cater. (*Radio Craft*, April 1946, Vol. 17, No. 7, pp. 467 . . 496.) Circuit details of German midget broadcast receivers.

621.396.621.029.62 **2295**

A Battery Operated V.H.F. Receiver.—E. L. Cameron. (*R.S.G.B. Bull.*, June 1946, Vol. 21, No. 12, pp. 185–186.) Design and construction of a simple two-unit portable receiver for the range 56–112 Mc/s.

621.396.621.54.029.62 **2296**

A Two-Meter Crystal-Controlled Converter.—C. F. Hadlock. (*QST*, May 1946, Vol. 30, No. 5, pp. 31–35.) For selective reception in the 112-Mc/s and 144-Mc/s amateur bands, a crystal-controlled beat oscillator converts the signal frequency to the 30–40-Mc/s region. Constructional details are given.

621.396.662.1 **2297**

New Tuning System for the Amateur Receiver.—W. J. Halligan & N. Foot. (*QST*, May 1946, Vol. 30, No. 5, pp. 18..124.) An application of split-stator capacitors giving improved v.h.f. performance with 3 to 1 tuning ranges up to 150 Mc/s. Basic circuits are given for an oscillator and mixer, with 6-band switching, to operate in the range 540 kc/s–110 Mc/s.

621.396.8 : 621.396.13 : 621.396.619.16 **2298**

Determination of Noise Power and Signal/Noise Ratio for the Case of Simplex or Multiplex Radio Transmission on Ultra-Short Waves by (A) Amplitude- or Duration-Modulated Pulses (B) Frequency-Modulated Pulses.—Chireix. (*See* 2307.)

621.396.8 : 621.396.619.018.41 **2299**

Nonlinearity in Frequency-Modulation Radio Systems Due to Multipath Propagation.—Meyers. (*See* 2321.)

621.396.822 **2300**

A Generalization of Nyquist's Thermal Noise Theorem.—E. J. Schremp. (*Phys. Rev.*, 1st/15th March 1946, Vol. 69, Nos. 5/6, p. 255.) Nyquist's theorem (1928 Abstracts p. 581) for the thermal current generator of a linear passive 2-terminal network at temperature T is extended for an M-terminal network to

$$[i^2_{mn}(r, a\,;\ \nu)]_{Av} = 2kTg_{mn}(r, a\,;\ \nu)\,d\nu$$

for the incoherent nodal currents if the generating parameter a obeys

$$a(-\nu)\,[a(\nu)-1]\,Y_{rr}(\nu) + a(\nu)\,[a(-\nu)-1]\,Y_{rr}(-\nu) = 0$$

where $y = g + jb$ is the admittance. Abstract of an Amer. Phys. Soc. paper.

621.396.823 : 621.317.7.089.6 **2301**

A Study of Wave Shapes for Radio-Noise-Meter Calibrations.—Frick. (*See* 2248.)

621.396.828 **2302**

Noise Limiting in C.W. Reception.—G. Grammer. (*QST*, May 1946, Vol. 30, No. 5, pp. 13..122.) Explains the poor results obtained with the usual amplitude limiter when using a beat-frequency oscillator, and gives a detailed description of a satisfactory clipper circuit for headphone reception, using germanium crystal rectifiers.

621.397.82 **2303**

Local Oscillator Radiation and Its Effect on Television Picture Contrast.—E. W. Herold. (*RCA Rev.*, March 1946, Vol. 7, No. 1, pp. 32–53.) A study of the effect of c.w. interference arising from the local oscillators of nearby receivers. The chief annoying effect of such interference at the high end of the video band was a serious loss in contrast. "The observations and computations indicated that a 20-db signal-to-interference field strength ratio at the antenna is a minimum satisfactory value. To maintain this ratio in a 500-μV/m region of a desired transmitter, nearby receivers must have a radiation below 0.01 μW. Pre-war receivers, which used no radio frequency stage, radiated 100 000 times as much as this and were extremely unsatisfactory. A grounded-grid triode r.f. stage may give a reduction of about 30 db or more and a pentode r.f. stage may be made even better." It is concluded that an adequate television service will require suppression of local-oscillator radiation if the frequency assignments are such as to make interference possible.

STATIONS AND COMMUNICATION SYSTEMS

621.396.1 **2304**

Communications : Implement to Peace.— R. C. Wakefield. (*Elect. Engng, N.Y.*, March 1946, Vol. 65, No. 3, pp. 99–105.) Description of developments in U.S. Army communications during the war, and of their application and adaptation to peace-time conditions. The main new proposals put forward are the provision of sufficient radio-relay stations, with control by one international company, and the use of pulse modulation and other multiplex systems in place of the more expensive (in frequency and money) cable systems.

621.396.1 **2305**

We Have New Regulations.—K.B.W. (*QST*, May 1946, Vol. 30, No. 5, pp. 23–24.) Revised F.C.C. rules for U.S. amateur radio.

621.396.13 **2306**

Observations and Comparisons on Radio Telegraph Signalling by Frequency Shift and On-Off Keying.—H. O. Peterson, J. B. Atwood, H. E. Goldstine, G. E. Hansell & R. E. Schock. (*RCA Rev.*, March 1946, Vol. 7, No. 1, pp. 11–31.) A long and fully detailed account of a thorough comparison in respect of communication reliability between on-off keying (CWT) and frequency-shift keying (FST) of transmissions on 200 kc/s from Bolinas, California, to Riverhead, New York. The CWT signals were received with a standard RCA 3-receiver diversity group, and the FST through a frequency-shift adaptor, using two receivers of the same diversity group. The comparison was based on error-counts on a 5-unit start-stop printer using a recurring series of test words transmitted from a loop of perforated tape. The conclusions were mainly in favour of the FST system.

621.396.13 : 621.396.8 : 621.396.619.16 **2307**

Determination of Noise Power and Signal/Noise Ratio for the Case of Simplex or Multiplex Radio Transmission on Ultra-Short Waves by (A) Amplitude- or Duration-Modulated Pulses (B) Frequency-Modulated Pulses.—H. Chireix. (*Ann. Radioélect.*, July 1945, Vol. 1, No. 1, pp. 55–64.) A theoretical study. The signal/noise ratio depends in each case on the gain in the transmission system, as in the case of keyed c.w. The analysis shows the system of frequency-modulated pulses to be effectively equivalent to a carrier-current system with the same total frequency deviation. Pulse duration modulation compares favourably with multichannel frequency modulation, and with frequency-modulated pulses when an upper and lower amplitude limiter is used on the receiver with the two thresholds brought as close together as possible.

621.396.24 + 621.396.933 **2308**

Aircraft Microwave-Beam System.—(*Aero Digest*, 15th June 1945, Vol. 49, No. 6, pp. 82–84.) A note on the application by the Raytheon Manufacturing Co. to the F.C.C. for permission to erect a microwave relay system and television broadcasting chain along the west coast of U.S.A. The potentialities of the scheme are discussed. See also 186 of January.

621.396.41 : 621.396.619.16 **2309**

A Selective Pulse Communication System.—A. R. Knight & H. Storck. (*QST*, May 1946, Vol. 30, No. 5, pp. 74..144.) A proposal by which many stations might work on the same frequency without interference. A master station transmits synchronizing pulses which control pulses emitted in keyed transmission from subsidiary stations. The master pulses also control gates in the receiving circuits, which can be adjusted manually in time relative to the master pulses. The gate is just wide enough to admit one pulse from any subsidiary transmitter, and is adjusted until it is open at the instants when the pulses from the selected transmitter arrive at the receiver.

621.396.619.018.41 **2310**

The Fundamental Principles of Frequency Modulation.—B. van der Pol. (*J. Instn elect. Engrs*, Part III, May 1946, Vol. 93, No. 23, pp. 153–158.) A theoretical survey of the nature, generation, and circuit response of f.m. waves. The voltage and current generated in a circuit with variable parameters are expressed in a form similar to the W.K.B. solution familiar in quantum mechanics. The response of a circuit to an f.m. wave is obtained in a form similar to that of Carson and Fry (464 of

1938) but it is shown that in general the resulting series is asymptotic.

621.396.619.018.41 : 001.4 **2311**

Defining Common F.M. Engineering Terms.—(*Electronic Industr.*, April 1946, Vol. 5, No. 4, pp. 79..81.) Short definitions of 17 terms.

621.396.619.018.41 : 621.3.012.3 **2312**

Frequency and Phase Deviation.—(*Electronic Industr.*, April 1946, Vol. 5, No. 4, pp. 69–70.) Two nomographs. The first relates modulating frequency, modulation index, and frequency deviation in the case of f.m., and modulating frequency, initial phase shift, and equivalent f.m. deviation in the case of ph.m. The second relates peak f.m. deviation and the modulating frequency to the condition required to give zero amplitude of the carrier frequency.

621.396.619.018.41 : 621.396.216 **2313**

F.M. Systems Engineering.—R. R. Batcher. (*Electronic Industr.*, April 1946, Vol. 5, No. 4, pp. 75..132.) A general survey of the requirements and methods of f.m. transmitting systems. A loose-leaf supplement gives schematic diagrams of the various parts of the system.

621.396.619.16 **2314**

Microwave Pulse [-time] **Modulation for Ham Communications.**—R. Endall. (*Radio News*, April 1946, Vol. 35, No. 4, pp. 41..94.) A general account of the principles and features of the system, including the use of the cyclodos and cyclophone cathode-ray-beam modulator and demodulator tubes. See also 1352 of May, 1056 of April (Black), and back references.

621.396.65.029.62[/.64] : 621.396.619.16 **2315**

Pulse-Modulated Radio Relay Equipment.—J. J. Kelleher. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 124–129.) An account of the development of the equipment used for military communications, with block diagrams and abridged specifications of the equipments AN/TRC-5 and AN/TRC-6. See also 1353 of May and back references.

621.396.664 **2316**

C.B.S. Studio Control-Console and Control-Room Design.—H. A. Chinn. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, pp. 287–295.) The chief design considerations for studio control equipment are location of controls and visual monitoring facilities, visibility into the studio, pleasing appearance, ease of maintenance, and flexibility.

The way in which the C.B.S. console fulfils these requirements is described, and its fitting into a complete studio layout to give maximum visibility is discussed. The circuit facilities of the console are outlined; space is available for additional equipment if required for special purposes.

621.396.664 **2317**

Two-Studio Console. — (*Electronic Industr.*, April 1946, Vol. 5, No. 4, pp. 71..130.) A Raytheon 7-channel programme-mixing console with separate amplifiers for each channel, a programme-level indicator and amplifier for the main output, and monitoring loudspeakers.

621.396.7 + 621.397.26 **2318**

The Programme of Work of la Radiodiffusion française.—M.A. (*Génie civ.*, 15th Feb. 1946, Vol. 123, No. 4, p. 52.) A brief summary of the plans for building new transmitting stations, studios, and laboratories, and for the development of television, and of a North African network.

621.396.712 **2319**

A Report on the Sixth Annual Conference of Broadcast Engineers.—L. Winner. (*Communications*, April 1946, Vol. 26, No. 4, pp. 30..74.) Long illustrated summaries of the following papers:—Preventive Maintenance for Broadcast Stations, by C. Singer. Irregular Room Surfaces in Studios, by K. C. Morrical. F.M. Station Monitor, by H. R. Summerhayes, Jr. For other papers see 2125, 2143 and 2365.

621.396.712 : 621.317.36 **2320**

The Measurement of Broadcast Station Frequencies.—Hers. (*See* 2246.)

621.396.8 : 621.396.619.018.41 **2321**

Nonlinearity in Frequency-Modulation Radio Systems Due to Multipath Propagation.—S. T. Meyers. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, pp. 256–265.) "A theoretical study is made to determine the effects of multipath propagation on over-all transmission characteristics in frequency-modulation radio circuits. The analysis covers a simplified case where the transmitted carrier is frequency-modulated by a single modulating frequency and is propagated over two paths having relative delay and amplitude differences. Equations are derived for the receiver output in terms of the transmitter input for fundamental and harmonics of the modulating frequency. Curves are plotted and discussed for various values of relative carrier- and signal-frequency phase shift and relative amplitude difference of the received waves.

"The results show that a special kind of amplitude nonlinearity is produced in the input-output characteristics of an over-all frequency-modulation radio system. Under certain conditions, sudden changes in output-signal amplitude accompany the passage of the input-signal amplitude through certain critical values. Transmission irregularities of this type are proposed as a possible explanation of so-called "volume bursts" sometimes encountered in frequency-modulation radio circuits. In general, it appears that amplitude and frequency distortion are most severe where the relative delay between paths is large and the amplitude difference is small."

621.396.82 : 551.57 : 629.135 **2322**

[U.S.] **Army-Navy Precipitation-Static Project: Part 4—Investigations of Methods for Reducing Precipitation-Static Radio Interference.**—G. D. Kinzer & J. W. McGee. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, pp. 234–240.) 'Studies showed that interfering noise associated with the use of bare-wire antennas was roughly proportional to the amount of corona-current discharge. It was found that the use of antennas insulated with polyethylene provided comparatively static-free radio reception by preventing corona discharge from the antenna. Correlated ground and flight experiments showed that, unless the corona discharge occurs at areas adjacent to antennas, little noise is produced in the radio receiver. The characteristics of several types of electrostatic dischargers, intended to reduce the equilibrium potential of the airplane for a given charging condition, were examined. The dry-wick discharger recently adopted by the military services was found to give the best over-all electrical and mechanical performance." The technique of measurement is described, and diagrams are shown of the noise as a function of the electric field intensity at the aerial.

621.396.82 : 551.57 : 629.135 : 621.3.027.7 **2323**

[U.S.] **Army-Navy Precipitation Static Project : Part 5 — The High-Voltage Characteristics of Aircraft in Flight.**—R. Gunn & J. P. Parker. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, pp. 241–247.) " The important high-voltage electrical characteristics of aircraft in flight are determined from (*a*) flight operations in precipitation areas ; (*b*) flight operations using a new artificial charger to electrify the airplane in flight ; (*c*) high-voltage experiments on the airplane supported in a giant hangar ; and (*d*) theoretical analysis.

" It is shown how the fundamental electrical constants of the airplane may be approximately determined and how these may be used to forecast the high-voltage behaviour of a flying aircraft. It is shown that, at a given altitude, the current I discharged by an airplane in flight is of the form

$$I = AE + B(E^2 - E_0^2)$$

where E is the magnitude of the electric field as measured on the belly and A, B and E_0 are constants.

" The electrical capacitance of an aircraft in flight is about 20% of the wing span expressed in centimetres." A theoretical analysis is given of the potential and space-charge distribution surrounding a sphere equivalent to an aircraft in a hangar, and close agreement is obtained between the observed and calculated currents.

621.396.931 **2324**

Mobile Radio Service.—(*Electronic Industr.*, April 1946, Vol. 5, No. 4, pp. 84–85.) An experimental semi-automatic f.m. radio telephone for party-line service to a fleet of vehicles.

621.396.931 **2325**

F.M. Railroad Radio Satellite System.—W. S. Halstead. (*Electronic Industr.*, June 1946, Vol. 5, No. 6, pp. 62–65..128.) Local 152–162-Mc/s f.m. transmitter-receiver stations with restricted service zones are connected to a central station by a 150–250-kc/s f.m. induction link that uses overhead wires primarily used for another purpose. Mobile v.h.f. units in the zone of any local station can communicate with any part of the system, or with other mobile units in any v.h.f. zone.

621.396.931.029.62 **2326**

A Method of Increasing the Range of V.H.F. Communication Systems by Multi-Carrier Amplitude Modulation.—J. R. Brinkley. (*J. Instn elect. Engrs*, Part III, May 1946, Vol. 93, No. 23, pp. 159–176.) " The initial development of a method of extending the range or improving the coverage of v.h.f. communication systems of the type used for police services is described. The method is based on the simultaneous amplitude modulation of a number of carriers closely spaced in frequency. The frequency spacing between the carriers is so chosen that they lie within the bandwidth of the v.h.f. receiver, without producing audible interaction components of importance.

" Two-carrier schemes employing separate transmitters at the same site have been found to give improved coverage, while two- and three-carrier schemes using separate sites have been found to give greatly increased range.

" An unsuccessful attempt to achieve the same object with . . . f.m. transmitters using the same nominal carrier frequency is described. The difficulties of employing frequency modulation with common modulation are discussed and considered to be fundamental.

" Single-station v.h.f. schemes upon which the development of the multi-carrier scheme is based are briefly described." A long discussion is included. For a less detailed account see 1357 of May.

SUBSIDIARY APPARATUS

621.314.2.029.4/.5] : 621.318.322 **2327**

Applications of Thin Permalloy Tape in Wide-Band Telephone and Pulse Transformers.—Ganz. (*See* 2225.)

621.314.22/.23 **2328**

The Impedances of Multiple-Winding Transformers : Part 3.—S. A. Stigant. (*Beama J.*, April 1946, Vol. 53, No. 106, pp. 139–141.) For previous parts see 1685 of June and 2017 of July.

621.315.612 : 546.287 **2329**

The Use of Liquid Dimethylsilicones to Produce Water-Repellent Surfaces on Glass-Insulator Bodies.—Johannson & Torok. (*See* 2214.)

621.316.721/.722].078.3 : 621.386 **2330**

The Stabilization of X-Ray Tube Current and Voltage.—A. F. LeMieux & W. W. Beeman. (*Rev. sci. Instrum.*, April 1946, Vol. 17, No. 4, pp. 130–132.) Description of circuits for stabilizing the current (up to 50 mA) and voltage (35 kV) of the discharge to 0.1% by means of degenerative feedback of the amplified variations to the primary a.c. power line. The stabilizer operates at ground potential.

621.316.74 **2331**

Tapered - Thickness Bimetal. — W. B. Elmer. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1945, Vol. 64, p. 962.) Discussion of 757 of March.

621.316.842 : 546.287 : 621.315.616.9 **2332**

Silicone Coating for [wire-wound] **Resistors.**—Marbaker. (*See* 2215.)

621.316.849.011.2 : 539.234 : 546.621 **2333**

Electrical Resistance of Thin Films of Aluminium Deposited on Glass by Thermal Evaporation.—Dunoyer. (*See* 2212.)

621.316.93 **2334**

Lightning Investigations on 33-kV Wood-Pole Lines.—F. E. Andrews & G. D. McCann. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1945, Vol. 64, pp. 954–955.) Discussion of 760 of March.

621.316.98 **2335**

The Frequency of Occurrence and the Distribution of Lightning Flashes to Transmission Lines.—R. H. Golde. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1945, Vol. 64, pp. 902–910.)

621.317.333.4 **2336**

Exploring Coils.—T. C. Henneberger. (*Bell Lab. Rec.*, April 1946, Vol. 24, No. 4, pp. 145–147.)

An a.f. source is used to produce a tracing current through the faulty cable, and an exploring coil detects the magnetic field so produced. Practical applications of the method are briefly discussed.

621.317.39.083.7 : 531.74 : 621.396.663 **2337**

Improvements in Devices for the Instantaneous Transmission of Angles.—Barthélemy. (*See* 2264.)

621.317.755 **2338**

The Precision High-Tension Oscillograph with Four Cathode Rays.—G. Induni. (*Brown Boveri Rev.*, Sept./Oct. 1943, Vol. 30, pp. 222–223.) Four separate deviation systems for voltages up to 3 kV, and two for voltages up to 50 kV. Continuously pumped. Abstract in *Rev. gén. Élect.*, Jan. 1946, Vol. 55, No. 1, p. 2D.

621.317.755.087.5 **2339**

An Automatic Oscillograph With a Memory.—A. M. Zarem. (*Trans. Amer. Inst. elect. Engrs*, March 1946, Vol. 65, No. 3, pp. 150–154.) The instrument has a flat response up to 30 Mc/s, and can be used for problems concerning randomly occurring transients. Three cathode-ray tubes allow simultaneous indications of inter-related quantities. The screens, which have a long afterglow, are continuously excited, and the occurrence of a transient pulse releases a camera shutter and interrupts the beams, so that events prior to the photographic exposure are recorded. Illustrations of sporadic disturbances in mercury arc rectifiers are given. The system is completely automatic, and 40 photographs can be taken without the aid of an operator. See also 3117 of 1937 and 666 of 1938 (Kuehni & Ramo), and 723 of 1939 (Pakala).

621.318.42 **2340**

Optimum Air Gap for Various Magnetic Materials in Cores of Coils Subject to Superposed Direct Current.—V. E. Legg. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1945, Vol. 64, p. 969.) Discussion of 763 of March.

621.318.423 **2341**

The Self-Inductance of a Toroidal Coil Without Iron.—H. B. Dwight. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1945, Vol. 64, p. 999.) Discussion of 765 of March.

621.319.4.011.4 **2342**

Resistance and Capacitance Relations Between Short Cylindrical Conductors.—F. L. ReQua. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1945, Vol. 64, p. 962.) Discussion of 766 of March.

621.319.42 : 621.315.616.9 **2343**

Polystyrene Capacitors.—J. R. Weeks. (*Bell Lab. Rec.*, March 1946, Vol. 24, No. 3, pp. 111–115.) Short description of the construction and performance. They are superior to mica capacitors in power factor, but are slightly bigger for the same capacitance, and have a greater temperature coefficient of capacitance.

621.319.5 : 621.317.2 **2344**

[U.S.] **Army-Navy Precipitation Static Project : Part 6—High-Voltage Installation of the Precipitation-Static Project.**—M. Newman & A. O. Kemppainen. (*Proc. Inst. Radio Engrs, W. & E.*, May 1946, Vol. 34, No. 5, pp. 247–254.) Description of the artificial lightning generator which gives any of (*a*) 1.5 MV at 1.5 mA d.c., (*b*) impulse voltages up to 5 MV, (*c*) impulse currents up to 200 000 A. The Cockcroft-Walton method of cascade rectifier connexion is used to build up the high voltage. "Conditions of electrical-field stress before the lightning discharge are produced by an automatically controlled transition of a generator of high-voltage direct current into a surge generator, resulting in a doubled field stress and a surge breakdown with lightning current characteristics. The combination is thus very suitable for studying certain phases of aircraft operation, particularly communications, under controlled laboratory conditions, corresponding to flight under electrical-storm conditions."

621.38 : 612.84 **2345**

The Electric Eye *v.* the Human Eye.—Sommer. (*See* 2361.)

621.389 : 623.555.2 **2346**

Invisible Light Aids Marksman.—(*Radio News*, June 1946, Vol. 35, No. 6, pp. 35..129.) General description of a device incorporating an infra-red spotlight and image converter for use with a rifle sight in the dark. The image converter has a photoelectric screen on which the i.r. image is formed, and the photoelectrons are focused by an electron lens on to a fluorescent screen to form a visible image.

621.396.614 **2347**

High-Frequency Alternators.—J. H. Walker. (*J. Instn elect. Engrs*, Part II, Feb. 1946, Vol. 93, No. 31, pp. 67–80.) A review of homopolar and heteropolar induction alternators for frequencies up to 50 kc/s, with an appendix giving the mathematics of novel features of the heteropolar type.

621.396.662 **2348**

A Visual Tuning Indicator Employing a Thyratron.—L. S. Joyce. (*Electronic Engng*, June 1946, Vol. 18, No. 220, pp. 183–186.) A thyratron with a.c. anode supply is controlled by a grid bias combining an a.c. supply of the same frequency but different phase, and a d.c. component obtained by rectification of the tuned signal. Change of the d.c. bias by tuning alters the striking point of the anode-voltage cycle and the mean anode current. The current is used to operate a meter or lamp indicator.

621.396.68 : 621.397.6 **2349**

Television Voltage [power supply] **Circuits : Part 13.**—E. M. Noll. (*Radio News*, June 1946, Vol. 35, No. 6, pp. 50..82.) For previous parts of this series on television circuits, see 1710 of June.

621.396.68.027.226 **2350**

Constant 6 Volt D.C. Supply for the Service Lab.—C. C. Springer. (*Radio News*, June 1946, Vol. 35, No. 6, pp. 44..146.) Constructional details of a battery charger, with automatic regulation to prevent overcharge, that can be used with a battery across its terminals as a constant 6-V source.

621.396.682 : 621.397 **2351**

Power Frequency Changers for Color Television.—D. L. Jaffe. (*Radio, N.Y.*, Feb. 1946, Vol. 30, No. 2, pp. 15–16.) A method for btaining power at 120 c/s from 60-c/s mains using an induction motor driven in reverse by a synchronous motor. The output is in synchronism with the mains

621.396.689 **2352**

Recent Developments in Heavy Duty Vibrator Type Power Supplies.—M. R. Williams. (*Radio News*, June 1946, Vol. 35, No. 6, pp. 46..151.) Operates from 32 V d.c., and gives a power supply of 350 W, 110–120 V a.c., at 60 c/s. A multiple-contact vibrator is used with a circuit that makes it unnecessary for all contacts to close in exact synchronism.

621.398 : 621.396.61 **2353**

All Purpose [amateur] **Transmitter Remote Control System.**—P. Johnson. (*Radio News*, June 1946, Vol. 35, No. 6, pp. 68..70.)

778.53 : 621.3 **2354**

A Wide-Angle Fastax.—J. H. Waddell. (*Bell Lab. Rec.*, April 1946, Vol. 24, No. 4, pp. 139–144.) A camera with a horizontal field of 40° using 35-mm film " for studying the action of relays, switches and other fast moving electrical apparatus."

621.317.755 + 621.385.832 **2355**

The Cathode-Ray Tube Handbook. [Book Review] —S. K. Lewer. Isaac Pitman & Sons, London, 100 pp., 6s. (*R.S.G.B. Bull.*, May 1946, Vol. 21, No. 11, p. 177.) " . . . very useful introduction to c.r.o. work."

621.318.5 **2356**

Relay Engineering [Book Review]—C. A. Packard. Struthers-Dunn, Philadelphia, Pa., 1945, 640 pp., $3.00. (*Electronic Industr.*, June 1946, Vol. 5, No. 6, p. 130.) " . . . covers the selection of relays, applications and circuits, auxiliary equipment, standards, and much material relating to the specific problems of designing the coil and contact structures . . ."

621.384 **2357**

Le Cyclotron. [Book Review]—M. E. Nahmias. Éditions de la Revue d'Optique Théorique et Instrumentale, Paris, 1945, 254 pp., 200 fr. (*Rev. sci. Instrum.*, April 1946, Vol. 17, No. 4, p. 135.) " The book is well written, concise and to the point", and particularly helpful in its treatment of theory and mathematical development.

621.385.833 **2358**

Electron Optics and the Electron Microscope. [Book Review]—V. K. Zworykin, G. A. Morton, E. G. Ramberg, J. Hillier & A. W. Vance. John Wiley & Sons, New York, 1945, 766 pp., $10.00. (*Rev. sci. Instrum.*, April 1946, Vol. 17, No. 4, pp. 138–139.) " In the opinion of the reviewer it is the best English language book yet published not only for electron microscopy but for general electron optics as well." See also 1960 of July.

TELEVISION AND PHOTOTELEGRAPHY

621.3.018.7 + 621.317.35 **2359**

Television Waveforms.—(*J. Televis. Soc.*, Sept. 1945, Vol. 4, No. 7, p. 178.) Reproduction of chart from *Electronic Engineering* giving equations for 16 common waveforms.

621.317.79 : 621.397.62 **2360**

A Television Signal Generator : Part 1—General Features.—Hibberd. (*See* 2255.)

621.38 : 612.84 **2361**

The Electric Eye *v.* the Human Eye.—W. Sommer. (*J. Televis. Soc.*, Sept. 1945, Vol. 4, No. 7, pp. 150–170.) An account of the characteristics and functions of the human eye, and of photoelectric cells. Data for these (sensitivity, etc.), and for photographic emulsions and for c.r.t. fluorescent screens are presented in tabular form. Long bibliography.

621.396.13 : 621.397 **2362**

Vertical *v.* Horizontal Polarisation.—Williams. (*See* 2289.)

621.397 **2363**

Where Color Television Stands.—D. G. Fink. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 104–107.) The similarities and differences between the black-and-white and the colour systems are discussed. It is shown that the colour system is likely to be more costly, and that there are still uncertainties in its performance requiring further research. Whether to continue with the present system, or to introduce the colour system immediately, depends upon the time required to assess the additional costs and to resolve the uncertainties. Whatever the decision there should be no delay in the research on the colour system.

621.397 **2364**

Color Television—Is it Ready to Adopt ?—(*Electronic Industr.*, April 1946, Vol. 5, No. 4, pp. 88..120.) A critical discussion of the C.B.S. colour television demonstration, which, using films as a source of programmes, avoided the colour fringe effect. " Quite a different result is expected by engineer critics when the live colour-pickup camera goes into action." A list of the advantages and drawbacks of colour and black-and-white television is given.

621.397 **2365**

A Report on the Sixth Annual Conference of Broadcast Engineers.—L. Winner. (*Communications*, April 1946, Vol. 26, No. 4, pp. 30..74.) Summary of the paper Televising Motion Picture Films, by S. Helt. For other papers see 2125, 2143 and 2319.

621.397 : 621.396.619.16 **2366**

Pulse-Width Modulation [for television sound channels].—(*Radio, N.Y.*, Feb. 1946, Vol. 30, No. 2, p. 4.) Illustrated summary of 459 of February.

621.397.2 **2367**

Discussion on " A Survey of the Problem of Post-War Television ".—B. J. Edwards. (*J. Instn elect. Engrs*, Part III, May 1946, Vol. 93, No. 23, pp. 216–220.) For original paper see 1109 of 1945.

621.397.26 **2368**

The B.B.C. Television Waveform.—(*Electronic Engng*, June 1946, Vol. 18, No. 220, pp. 176–178.) A revised specification of the radiated waveform of the B.B.C. transmissions, with diagrams, and with an appendix explaining the method of interlacing. Reprinted from 637 of 1939.

621.397.26 **2369**

Facsimile Methods for Broadcast Work.—(*Electronic Industr.*, June 1946, Vol. 5, No. 6, pp. 74..119.) A general account of the " Faximile " and " Telefax " systems.

621.397.26 **2370**

A New Television System : " Stratovision ".—M. Adam. (*Génie civ.*, 15th March 1946, Vol. 123, No. 6, pp. 76–77.) See also 3970 of 1945.

621.397.5 **2371**

Field Television.—R. E. Shelby & H. P. See. (*RCA Rev.*, March 1946, Vol. 7, No. 1, pp. 77–93.) A résumé of the history of N.B.C. operations, with special reference to the greatly widened scope made possible by use of the image orthicon camera. The article concludes that there are now virtually no technical limitations on the televising of indoor programmes with normal illumination, and that the image orthicon camera "represents the greatest single advancement so far made in field television". See also 2374 below.

621.397.6 : 621.396.68 **2372**

Television Voltage [power supply] **Circuits: Part 13.**—Noll. (*See* 2349.)

621.397.61 **2373**

C.B.S. Color or Fine Line Television Transmitter.—(*See* 2386.)

621.397.611 **2374**

Image Orthicon Camera.—R. D. Kell & G. C. Sziklai. (*RCA Rev.*, March 1946, Vol. 7, No. 1, pp. 67–76.) A description of one of a series of developmental television cameras using the image orthicon. It is self contained, and weighs less than 40 lb. The power required is 300 W, and may be taken from a non-regulated supply. As an illustration of the sensitivity, there are three half-tone reproductions of a television picture of the head and shoulders of a subject illuminated with a 3-kW light, a 25-W desk lamp, and one candle respectively. For a brief description of the image orthicon itself see 1376 of May.

621.397.62 **2375**

Tele Color Reception.—R.R.B. (*Electronic Industr.*, April 1946, Vol. 5, No. 4, pp. 82..118.) A description of the C.B.S. colour television apparatus to guide experimenters in building receiving sets. Various designs for colour-wheel filter segments are discussed. For a fuller account see 2051 of July (D.G.F.).

621.397.82 **2376**

Local Oscillator Radiation and Its Effect on Television Picture Contrast.—Herold. (*See* 2303.)

TRANSMISSION

621.396.61.029.58 **2377**

100 Watt—28 Mc Transmitter.—N. Lefor. (*Radio News*, April 1946, Vol. 35, No. 4, pp. 50–51.) Constructional details of a crystal-controlled 6L6 oscillator with 829B (beam double tetrode) frequency doubler and anode-modulated output stages.

621.396.61.029.62 **2378**

Transmitter for 2 Meters.—E. F. Crowell & R. L. Parmenter. (*Radio News*, June 1946, Vol. 35, No. 6, pp. 28..144.) Constructional details of an amateur a.m. or i.c.w. equipment that can be received consistently over 15–25 miles.

621.396.619 **2379**

Class "C" Grid Bias Modulation: Part 1.—W. W. Smith. (*Radio News*, April 1946, Vol. 35, No. 4, pp. 55..111.) An account of methods of reducing distortion by stabilization and by maintenance of correct operating conditions, including a comparison with class-B and anode modulation.

621.396.619.018.41 **2380**

A New Exciter Unit for Frequency Modulated Transmitters.—N. J. Oman. (*RCA Rev.*, March 1946, Vol. 7, No. 1, pp. 118–130.) A detailed account of the development and final design of a unit based on a reactance-tube modulator, as distinct from the Armstrong phase-shift system. A special feature is the stabilization of the carrier frequency by reference to a crystal-controlled oscillator by means of a capacitor mounted on the shaft of an induction motor which rotates in sense according to the sense of the frequency displacement. It is stated that the accuracy of this frequency control is limited by the heat cycle of the crystal oven. The distortion in the f.m. output of the exciter is of the order of 0.5% for modulating frequencies from 30 to 15 000 c/s. The noise level is 74 db below 100% modulation.

621.396.619.018.41 **2381**

Frequency Modulation by Non-Linear Coils.—L. R. Wrathall. (*Bell Lab. Rec.*, March 1946, Vol. 24, No. 3, pp. 102–105.) The current/magnetic-flux relationship in a coil wound on a permalloy core is nonlinear, and results in the occurrence of voltage pulses at each reversal of sign of the current. Addition of relatively low frequency signal current to the carrier current causes shifting of the position in time of current zeros, and therefore of voltage pulses, in opposite directions for positive and negative pulses. The pulses are thus phase-modulated. Pulses of one polarity are separated by a rectifier, and one of the harmonics selected by a band-pass filter.

621.396.619.018.41 **2382**

WHFM's F.M. Converter.—K. J. Gardner. (*Electronic Industr.*, April 1946, Vol. 5, No. 4, pp. 80–81.) The adaptation of a 45.1-Mc/s transmitter for simultaneous operation on 98.9 Mc/s. A circuit diagram is given. The r.f. output is 1 kW.

621.396.619.018.41 **2383**

Direct Frequency-Modulation Modulators.—N. Marchand. (*Communications*, April 1946, Vol. 26, No. 4, pp. 42..59.) An analysis of miscellaneous types of modulators not using the reactance tube. Input capacitance, transmission line, RC f.m. oscillator, and inductively coupled types are discussed, and design equations given. These systems employ a two-terminal impedance with a reactive component that varies with modulating voltage. For previous parts in this series see 1994 & 2068 of July.

621.396.662.078.3 : 621.396.619.018.41 **2384**

New Transmitter Circuits.—(*Radio, N.Y.*, Feb. 1946, Vol. 30, No. 2, p. 35.) A block diagram of the Federal f.m. stabilization system in which an f.m. oscillator is controlled by a crystal oscillator. The resulting output of the modulated oscillator is phase modulated with respect to the fixed oscillator.

621.396.662.078.3 : 621.396.619.018.41 **2385**

F.M. Frequency Control System.—J. R. Boykin. (*Radio, N.Y.*, Feb. 1946, Vol. 30, No. 2, pp. 20..63.) Each cycle of the beat between the modulated frequency and a fixed reference frequency is used to produce a pulse, the polarity of which depends on whether the reference frequency is greater or less than the other. The pulses are sorted according to polarity, integrated, and used to produce a voltage for correcting the mean frequency of the modulated oscillator. The system regulates the oscillator frequency so that the areas of the frequency/time curve above and below the reference frequency are kept equal.

621.397.61 **2386**

C.B.S. Color or Fine Line Television Transmitter.—(*Radio, N.Y.*, Feb. 1946, Vol. 30, No. 2, pp. 31..58.) Description of a 600-W transmitter for 490 Mc/s, that can be amplitude-modulated from 0 to 10 Mc/s. A 6.8-Mc/s crystal-controlled oscillator feeds a chain of frequency-multipliers and amplifiers, the final stage being modulated by the output of a video-frequency amplifier having d.c. coupling between stages.

VALVES AND THERMIONICS

621.385 **2387**

Mechanism of the Operation of Kenotrons with Cold Emission.—V. Sorokina. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 61.) Abstract of a paper of the Acad. Sci., U.S.S.R.

621.385 **2388**

The Role of Surface Charges in Electron Devices.—P. Timofeev. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 61.) When an insulator is placed near the cathode a large potential gradient can be created due to secondary emission. Cold emission from the cathode can then occur. Kenotrons with cold cathodes have been devised with a potential drop below 100 V. Abstract of a paper of the Acad. Sci., U.S.S.R.

621.385 **2389**

The Passage of High-Frequency Currents through Electronic Devices.—G. Gvosdover. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 63.) The successive approximations for the potential drop in a plane capacitor, carrying a variable electron beam, are established by expanding a power series of a small parameter. Cases considered include electron currents in the klystron and diode, and in the former the dependence of amplitude and wavelength of oscillation on current strength. Abstract of a paper of the Acad. Sci., U.S.S.R.

621.385 **2390**

Electronic Devices with Effective Emitters of Secondary Electrons.—P. Aranovich. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 61.) Various metallic oxides with large secondary-emission coefficients have been investigated. The emission varied considerably with field gradient, and was reduced greatly by depositing fine metallic films on the oxide surface. Strong emission is accompanied by luminescence of the surface. Abstract of a paper of the Acad. Sci., U.S.S.R.

621.385 **2391**

Velocity Modulation.—J. E. Kauke. (*Radio News*, Feb. 1946, Vol. 35, No. 2, pp. 44..74.) An elementary description of the principle, and its application to twin-cavity and reflex klystrons.

621.385 **2392**

Contribution to the Physics and Technique of Velocity-Modulated Electronic Transmitting Tubes.—R. Warnecke. (*Onde élect.*, Sept. & Oct. 1945, Vol. 20, Nos. 222 & 223, pp. 47–60 & 72–100.) Reprint of 3879 of 1945.

621.385 **2393**

Some Electrical Characteristics of Reflex [velocity-modulated] **Tubes.**—H. V. Neher. (*Phys. Rev.*, 1st/15th Feb. 1946, Vol. 69, Nos. 3/4, p. 134.) ". . . expressions are derived for the efficiency and electronic tuning when the transit angle across the gap in the cavity has its optimum value and the tube is delivering maximum power to the load." Abstract of an Amer. Phys. Soc. paper.

621.385 : 538.312 **2394**

Energy Conversion in Electronic Devices.—D. Gabor. (*J. Instn elect. Engrs*, Part I, May 1945, Vol. 92, No. 53, pp. 208–209.) Summary of 1071 of 1945. For discussion, see same journal Part III, Vol. 93, No. 22, pp. 126–127.

621.385.012.6 **2395**

Oscillograms of Valve Characteristics.—B. D. Chhabra, H. R. Sarna & M. Parkash. (*Curr. Sci.*, Dec. 1945, Vol. 14, No. 12, pp. 319–320.) The dynamic characteristics traced with sine-wave excitation become looped or closed curves, even if the anode and grid resistances are non-inductive, provided the grid resistance is greater than a certain maximum value.

621.385.032.21 **2396**

A Note on the Protection of Heaters for Cathodes.—E.M.I. Laboratories. (*Electronic Engng*, April 1946, Vol. 18, No. 218, p. 112.) Protection of the brittle cathode-heater insulation during cathode assembly is obtained by coating it with a skin, *e.g.* by applying a solution of nitro-cellulose in amyl acetate, which vaporizes during the heat-processing of the valve.

621.385.032.24 **2397**

Some Electrostatic Properties of Grid Electrodes.—V. Lukoshkov. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 1, p. 61.) An analysis using the conception of an infinitely fine ideal grid which can be replaced by a complete electrode of the same shape having an effective variable potential distribution. Abstract of a paper of the Acad. Sci., U.S.S.R.

621.385.16 **2398**

Separate Cavity Tunable Magnetron.—G. D. O'Neill. (*Electronic Industr.*, June 1946, Vol. 5, No. 6, pp. 48..123.) A disk-sealed tube is clamped in a single external annular-cavity resonator that is tuned by screwed plugs. The particular magnetron described generates 4-μs 80-W pulses of about 6-cm wavelength at about 10% efficiency.

621.385.16(52) **2399**

Japanese Magnetrons.—M. Hobbs. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 114–115.) Japanese war-time valve research in the microwave region was concentrated on centimetre-wave magnetrons. Magnetrons were used as local oscillators, for practically no progress had been made with small klystrons.

621.385.16.029.64 **2400**

The Multi-Cavity Magnetron.—(*Bell. Lab. Rec.*, June 1946, Vol. 24, No. 6, pp. 219–223.) An illustrated descriptive account.

621.385.3 : 621.396.615 **2401**

Circuits for Sub-Miniature Tube.—F. R. (*See* 2149.)

621.385.832 **2402**

Improved Cathode-Ray Tubes with Metal-Backed Luminescent Screens.—D. W. Epstein & L. Pensak. (*RCA Rev.*, March 1946, Vol. 7, No. 1, pp. 5–10.) The application of a light-reflecting electron-pervious, thin metallic layer on the beam side of the luminescent screen is claimed to have the following advantages :—1. Improved efficiency of conversion of electron beam energy into useful light. 2. Elimination of ion spot—thus making other, generally less direct, means for eliminating the ion spot unnecessary. 3. Improved contrast. 4. Elimination of secondary emission restrictions—thus permitting the use of high voltages and screen materials with poor secondary emission. The chief effect of such a film is to throw forward the light that would otherwise be radiated back towards the gun. The idea is not new, but recent improvements in technique, which are detailed in the article, have now made it possible and practical. The metal now used is aluminium, the range of thickness being 500–5 000Å. An important innovation has been the covering of the fluorescent material, before the deposition of the aluminium, with a thin film of organic material. This makes it possible to get the necessary smooth and mirror-like surface on the aluminium.

621.385.832 **2403**

Origin of Ion Burn in Cathode-Ray Tubes.—G. Liebmann. (*Nature, Lond.*, 23rd Feb. 1946, Vol. 157, No. 3982, p. 228.) This effect is thought to be due to negative ions issuing from the thermionic cathode. Ion burns showing distinctive patterns corresponding to the electron emission patterns of the cathodes were observed. Details are given of an experiment demonstrating this effect using a tube with magnetic deflexion and focusing.

621.385.832 : 621.396.9 **2404**

The Skiatron in Radar Displays.—P. G. R. King : D. S. Watson. (*Electronic Engng*, June 1946, Vol. 18, No. 220, pp. 172–173.) A description of the dark-trace tube used as a light valve to obtain large-screen radar displays by projection methods. Electron bombardment of a c.r.t. screen composed of alkali-halide crystals produces a dark coloration on an otherwise white background, and episcopic projection using intense external illumination produces a magnified image. The coloration produced decays at a slow rate dependent on the conditions of electron bombardment, illumination, and temperature, the latter being regulated by forced air circulation in the equipment described. Extract from a lecture by King at the I.E.E. Radiolocation Convention, with additions from a paper by Watson.

621.385.832 : 621.397.62 **2405**

Some Novel Projection Type Television Tubes.—(*Electronic Engng*, June 1946, Vol. 18, No. 220, p. 186.) A short note from the E.M.I. Laboratories.

621.396.694 **2406**

The Calculation of Amplifier Valve Characteristics.—G. Liebmann. (*J. Instn elect. Engrs*, Part III, May 1946, Vol. 93, No. 23, pp. 138–152.) " The anode-current/grid-voltage characteristics of valves are determined with the help of diagrams and design charts based on Langmuir's data on the current flow in plane diodes with consideration of initial electron velocities, and on Oertel's and Herne's equations for the amplification factor. The theory is extended to multi-grid valves and to valves possessing a more complicated shape. Special attention is given to the " variable-mu effect ", which represents one of the limiting factors in practical valve construction. A simple expression describing this effect is derived, and a chart of the " variable-mu constant ", α, is presented, in which space charge is taken into account. Measurements on specially made experimental valves and on several types of modern mass-produced valves confirm the treatment of the variable-mu effect and show that the methods outlined in the paper, forming a complete design system, allow the prediction of the static valve characteristic with good accuracy even in closely spaced modern valves. Finally, the influences of a change in control-grid wire diameter, of a statistical variation of control-grid pitch, and of cathode misalignment, are discussed." See also 1812 of 1937 (Benjamin *et al.*) & 3395 of 1943 (Thompson).

MISCELLANEOUS

001.891 : 08 **2407**

A Neglected Aspect of Research.—T. Coulson. (*J. Franklin Inst.*, March 1946, Vol. 241, No. 3, pp. 187–193.) A more thorough exploration of available literature and patent specifications by extensive library research at the outset of a research programme would save effort and money.

026 : 621.396 **2408**

A Reference Library for Radio Engineers.—G. J. Hunt. (*Electronic Engng*, June 1946, Vol. 18, No. 220, pp. 187–188.) Suggested list of 10 journals and 75 textbooks for a radio reference library. Headings for an alphabetic subject index are suggested.

029 **2409**

Documentary Reproduction.—L. Moholy. (*Nature, Lond.*, 12th Jan. 1946, Vol. 157, No. 3976, pp. 38–40.) Mainly an account of the present and possible uses of microfilm. The subject is also discussed editorially on pp. 29–30.

061.22 : 621.396(054) **2410**

Waves and Electrons.—The designation of this publication as " Proc. Inst. Radio Engrs, Section II ", with separate paging, stopped after April 1946. " Proc. Inst. Radio Engrs and Waves and Electrons " is now paged as one journal, and will be referred to as *Proc. Inst. Radio Engrs, W. & E.* See 1740 of June and 1122 of April.

061.231 : 62 **2411**

[A.I.E.E.] **Planning Subcommittee Issues Progress Report on Study of Organization of Engineering Profession.** — American Institute of Electrical Engineers. (*Elect. Engng, N.Y.*, April 1946, Vol. 65, No. 4, pp. 169–173.) Full text of report.

061.5 : 621.3(054–2) **2412**

Philips Research Reports.—A new bi-monthly journal describing the results of research at the Philips Laboratories. Abstracts of papers in the first number were given in July.

061.5 : [621.38 + 621.396 **2413**

The [wartime] **Work of the B.T.-H. Research Laboratory.**—(*Beama J.*, March 1946, Vol. 53, No. 105, pp. 102–107.)

061.6 : 621.3 **2414**

The British Electrical and Allied Industries Research Association.—(*Engineer, Lond.*, 15th Feb. 1946, Vol. 181, No. 4701, pp. 155–156.) A summary of the report for 1945. Items discussed include work on dielectric materials; gas-blast circuit breakers for heavy duty; radio interference at frequencies below 25 Mc/s; magnetic material research; the "capacitor transformer"; surge phenomena and effects of lightning on overhead lines. See also *Electrician*, 8th Feb. 1946, Vol. 136, No. 3532, pp. 341–342.

061.6 : 621.3.027.3 **2415**

High-Voltage Research at the National Physical Laboratory.—R. Davis. (*Engineer, Lond.*, 23rd & 30th Nov. 1945, Vol. 180, Nos. 4689 & 4690, pp. 412–413 & 435–436.) Very long summary of the I.E.E. Parsons Memorial Lecture.

061.6 : [621.38 + 621.3.029.6 **2416**

Research Laboratory of Electronics at the Massachusetts Institute of Technology.—J. A. Stratton. (*Rev. sci. Instrum.*, Feb. 1946, Vol. 17, No. 2, pp. 81–83.) Announcement of the organization of a new laboratory to undertake research on microwaves, electronic techniques, and electronic aids to computation.

061.6 : 621.39 **2417**

Telecommunications Research. — (*Elect. Rev., Lond.*, 24th May 1946, Vol. 138, No. 3574, pp. 811–812.) Description of work at the (British) Post Office research station at Dollis Hill. Lines of investigation include the submarine repeater, the vocoder system, for converting speech to a telegraph-like code for transmission and reconstructing it at the receiver, coaxial-cable telephony, the production of crystal resonators, and methods of countering the effects of fading in radio reception.

347.771(73) **2418**

Final Report of the National Patent Planning Commission.—A. W. Graf. (*Proc. Inst. Radio Engrs, N.Y.*, Part II, April 1946, Vol. 34, No. 4, p. 198.) Suggestions for improving the American system.

5+6] : 623 **2419**

Impact of the War on Science.—L. J. Briggs. (*Elect. Engng, N.Y.*, Jan. 1946, Vol. 65, No. 1, pp. 8–10.) An account of the resulting acceleration in scientific research.

5+6] "1939/1945" **2420**

The Scientist in Wartime.—E. V. Appleton. (*Engineer, Lond.*, 23rd & 30th Nov. & 7th Dec. 1945, Vol. 180, Nos. 4689–4691, pp. 417–419, 432–433 & 454–455.) Very long summary of the Thomas Hawksley Lecture at the Instn Mech. Engrs.

519.283 **2421**

Quality Control through Product Testing.—P. L. Alger. (*Elect. Engng, N.Y.*, Jan. 1946, Vol. 65, No. 1, pp. 11–12.) The procedure required for statistical quality control is defined, and methods of sample testing to maintain an assigned level of quality are given.

519.283 **2422**

Statistical Methods in Quality Control: Part 8.—A.I.E.E. Subcommittee on Educational Activities. (*Elect. Engng, N.Y.*, Jan. 1946, Vol. 65, No. 1, pp. 23–24.) "The use of control charts for action when inspection is by the method of variables and the factors for control are averages and ranges . . The method is illustrated by a typical application; the cutting of small sleeves from a tubing material where weight is one of the critical characteristics to be controlled." For parts 7 and 9 see 1411/1412 of May; for previous parts see 805 of March.

519.283 **2423**

Statistical Methods in Quality Control: Part 10—Classification of Defects and Quality Rating.—A.I.E.E. Subcommittee on Educational Activities. (*Elect. Engng, N.Y.*, March 1946, Vol. 65, No. 3, pp. 117–119.) A measure of quality as the ratio of defective units to total units is usually adequate for simple products. It is suggested that for more complex products, classification of defects according to seriousness is needed, and quality rating by number of demerits per unit is explained.

519.283 **2424**

Quality Control of Production.—Statistician. (*Beama J.*, Feb. 1946, Vol. 53, No. 104, pp. 42–44.)

519.283 **2425**

Statistical Tools for Controlling Quality. — J. Manuele & C. Goffman. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1945, Vol. 64, pp. 949–951.) Discussion of 503 of February.

519.283 **2426**

Statistical Methods in the Development of Apparatus Life Quality.—E. B. Ferrell. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1945, Vol. 64, pp. 998–999.) Discussion of 804 of March.

519.283 : 519.24 **2427**

A Simple Test of Significance.—(*Engineering, Lond.*, 30th Nov. 1945, Vol. 160, No. 4168, p. 452.) Letter proposing a method of determining whether there is a significant difference between the results of two comparative series of measurements.

519.283 : 621.315.62 **2428**

Statistical Methods Applied to Insulator Development and Manufacture.—J. J. Taylor. (*Trans. Amer. Inst. elect. Engrs*, December Supplement 1945, Vol. 64, p. 952.) Discussion of 255 of January.

536.2 : 621.3.012.8 **2429**

The Accuracy of Lumping in an Electric Circuit representing Heat Flow in Cylindrical and Spherical Bodies.—V. Paschkis & M. P. Heisler. (*J. appl. Phys.*, April 1946, Vol. 17, No. 4, pp. 246–254.) "In using lumped resistance-capacitance circuits for studying heat conduction problems the influence of number and size of lumps is important. Several methods of lumping are conceivable for representation of cylindrical or spherical bodies and results of comparative tests show that equal geometrical size of lumps is most accurate. In the various lumps resistance and capacitance have to be in certain definite relationships, which are established in the paper. The influence of number of lumps is also investigated."

538.323 **2430**

An [alternating-current] **Electromagnet for Non-Magnetic Substances.**—W. V. Lovell. (*Phys. Rev.*, 1st/15th March 1946, Vol. 69, Nos. 5/6, p. 251.) The device depends on the interaction between currents in the "magnet" coil and induced currents in nearby conductors. Abstract of an Amer. Phys. Soc. paper.

551.575 **2431**

A Method of Determining the Size of [fog] **Droplets Dispersed in a Gas.**—R. L. Stoker. (*J. appl. Phys.*, April 1946, Vol. 17, No. 4, pp. 243–245.) " A method applicable to determining droplet sizes in the interior of an already existing atmosphere of fog or mist is developed and described. The method makes use of the fact that if droplets strike a suitably [soot-] coated surface without wetting the surface, a track of the contact area is formed. A criterion is derived and experimentally evaluated for relating the droplet diameter and the track diameter."

614.825 : 621.396.61 **2432**

Safety in the Shack.—(*R.S.G.B. Bull.*, June 1946, Vol. 21, No. 12, pp. 181, 184.) Recommendations for safe operation of amateur transmitters.

620.197+621.314.634 **2433**

Cathodic Protection and Applications of Selenium Rectifiers.—W. F. Bonner. (*Elect. Comm.*, 1945, Vol. 22, No. 4, p. 338.) Correction to 1944 of 1945.

621–752 **2434**

Modern Vibration Control Installations for Aircraft Radio and Instruments.— (*Aero Digest*, 1st June 1945, Vol. 49, No. 5, pp. 89–91, 144.) Description and performance of the " Vibrashock " suspension mount. " . . . any attempt to design a so-called ' standard ' mount will necessarily prove unsatisfactory."

621.3 (07) **2435**

Post-Graduate Engineering.—(*Elect. Rev., Lond.*, 15th Feb. 1946, Vol. 138, No. 3560, p. 257.) Summary of I.E.E. discussion on " Post-Graduate Courses in Electrical Engineering including Radio " led by W. Jackson and J. Greig.

621.3.081.4 **2436**

Absolute Bels.—F. S. G. Scott. (*Wireless Engr*, May 1946, Vol. 23, No. 272, pp. 132–139.) Author's definition :—" When any power (P$_x$) is compared (in bels) with one watt, the resultant answer is expressed in absolute bels." The symbol B is proposed for the absolute bel, with dB for the absolute decibel. It is also proposed that factors (forces, lengths, resistances, etc.) which are not themselves power, but which determine power in certain circumstances, may be expressed in bels. The application of these proposals is illustrated by reference to electrical and acoustical systems.

621.316.93 : 629.13 **2437**

Method of Removing Static Charges from Moving Bodies.—R. C. Ayres. (*Radio, N.Y.*, March 1946, Vol. 30, No. 3, p. 49.) Essentially for dissipating precipitation static charges on aircraft. Summary of U.S. Patent 2 386 084.

621.38/.39](43) **2438**

German Electronic Equipment. — (*Elect. Rev., Lond.*, 15th March 1946, Vol. 138, No. 3564, p. 429.) A short account of the S.I.G.E.S.O. exhibition of German service equipment including radar, infra-red technique, and guided missiles.

621.38 : 778 **2439**

Electronic Flash Tubes.—D. A. Senior. (*Electronic Engng*, May 1946, Vol. 18, No. 219, pp. 133–135, 141.) Application of high-speed photography to the study of under-water explosions. Exposure may be controlled by a high-speed shutter or by using intense flashes of short duration for illumination.

621.396 **2440**

Radio at the Paris Fair (8–24 Sept. 1945).—M. Adam. (*Génie civ.*, 1st Nov. 1945, Vol. 122, No. 21, pp. 168–169.) A review of the exhibits under the headings French broadcasting, broadcast receivers, television receivers, components, miscellaneous equipment, and test gear.

621.396.828 : [621.365.5+621.365.92 **2441**

Radiation from R.F. Heating Generators.—A. G. Swan. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 162 . . 170.) Sufficient attenuation of the radiation is obtained by the use of a double-shielded room, constructed of copper or steel net up to $\frac{1}{2}$-inch mesh. A filter at the mains input prevents radiation from the power lines.

621.396.933 **2442**

The Aircraft Radio Serviceman.—T. Wayne. *Radio News*, April 1946, Vol. 35, No. 4, pp. 28 . . 116.) Hints on the installation and maintenance of radio equipment in small private aircraft. The causes of precipitation static and means of reducing it are considered.

658 : 621.396.621 **2443**

Mass Production.—H. G. Shea. (*Electronic Industr.*, June 1946, Vol. 5, No. 6, pp. 51–55, 123.) Description of organization and methods employed in a typical receiver manufacturing plant. Emphasis is placed on cutting the number of departments to a minimum, thereby reducing the administrative staff required, and on keeping rigidly to time schedules for every operation.

519.283 **2444**

Sequential Analysis of Statistical Data : Applications. [Book Review]—Statistical Research Group, Columbia Univ. Columbia Univ. Press, New York, $6.50. (*Science*, 19th April 1946, Vol. 103, No. 2677, pp. 490–492.)

621.3 **2445**

Basic Electrical Engineering. [Book Review]—A. E. Fitzgerald. McGraw-Hill Book Co., New York, 1945, 441 pp., $ 3.75. (*Electronic Industr.*, Jan. 1946, Vol. 5, No. 1, p. 128). " A text book for students majoring in engineering, covering circuits, machines and electronics."

621.396 **2446**

Principles of Radio. [Book Review]—K. Henney. John Wiley & Sons, New York, 5th edn. 1945, $3.50, 21s. (*Engineering, Lond.*, 21st Dec. 1945, Vol. 160, No. 4171, p. 511.) " Can be recommended as a comprehensive course, suitable for those beginning the study of radio."

ABSTRACTS AND REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534 : 621.392 **2447**

Electro-Mechanical Analogy in Acoustic Design.—A. M. Wiggins. (*Radio, N.Y.*, April 1946, Vol. 30, No. 4, pp. 28–29.) An explanation and justification of the analogy whereby mechanical problems can be solved by the solution of equivalent electrical circuits. The method is applied to a unidirectional microphone.

534.2 **2448**

The Absorption of Sound of High Frequency in Metals.—L. Gurevich. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, No. 6, pp. 202–204.) From an equation (1) determining the change in the number of sound quanta (phonons) resulting from their interaction with electrons, a formula is derived for calculating the absorption coefficient τ_g. It appears that τ_g is proportional to the sound frequency. It is also shown that for frequencies exceeding the inverse value of the time of the free travel of electrons, sound is absorbed during an interval of the order of the sound period, *i.e.* propagation cannot take place.

This paper is related to 2232 of 1937 (Landau & Rumer).

534.321.9 **2449**

Ultrasonic Velocity in Water.—P. L. F. Jones & A. J. Gale. (*Nature, Lond.*, 16th March 1946, Vol. 157, No. 3985, p. 341.) A graph is given showing the velocity as a function of temperature. There is a maximum of 1552.7 m/s at 72.7°C. See also B. K. Singh, *Nature, Lond.*, 1945, Vol. 156, p. 569.

534.321.9 **2450**

On the Measurement of Ultra-Sound Absorption in Gases by Spherical Waves Methods.—P. Krasnushkin. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, No. 5, pp. 152–155.) The advantages of using spherical instead of plane waves for the measurements are pointed out, and the following two new methods proposed: (*a*) A point receiver is moved along the axis of the central diffraction lobe of the radiation field of a point radiator, and amplitudes V of the field are measured with respect to distance R between the radiator and the receiver. (*b*) The receiver is replaced by a metallic plane that reflects the waves back to the radiator. With a continuous movement of the plane the acoustic reactance of the radiator and therefore the anode current I_a of the oscillator are varied. A formula determining the relationship between I_a and d (distance between the plane and the radiator) is given.

The results obtained by both methods in room air are shown in a table. It appears that for the frequencies used (400–710 kc/s) $d\lambda^2$ remains constant within 7%, and its average value is 23.7×10^{-5}, *i.e.* it exceeds by 44% the value given by the classical theory.

534.321.9 : 621.396.9 **2451**

Ultrasonic [radar] **Trainer Circuits.**—Larsen. (*See* 2582.)

534.417 : 534.88 **2452**

Navy Releases Sonar Story.—(*Electronics*, May 1946, Vol. 19, No. 5, pp. 284..294.) A general account of the system and its history. See also 1750 of July (Lanier & Sawyer).

534.43 : 621.395.61 **2453**

A New Moving-Coil [gramophone] **Pickup.**—(*Electronic Engng*, July 1946, Vol. 18, No. 221, pp. 224–226.) Detailed description of the "Lexington" pickup, which has a flat response from 30 c/s to 12 kc/s, with a weight of ½ oz on the record. Sapphire or steel needles of special shape are used.

534.43 : 621.395.61 : 538.652 **2454**

Torsional Magnetostriction [gramophone] **Pickup.**—S. R. Rich. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 107–109.) The device makes use of the variation of magnetic reluctance in a wire subjected to torsion in a magnetic field. It has a small moving mass, low distortion, and wide frequency response. The torsional magnetostriction element also operates successfully as a recording mechanism.

534.43 : 621.395.645.3 **2455**

Unique Phono Amplifier.—Pett. (*See* 2515.)

534.61 : 621.317.35 **2456**

Range Extender for General Radio 760A Sound Analyzer.—J. D. Cobine & J. R. Curry. (*Rev. sci. Instrum.*, May 1946, Vol. 17, No. 5, pp. 190–194.) Details of a circuit to extend the frequency range to 1 Mc/s by a heterodyne principle.

621.395.2 + 621.395.625 **2457**

Nuernberg Trials Recording System.—P. C. Erhorn. (*Electronic Industr.*, June 1946, Vol. 5, No. 6, pp. 70..114.) A block diagram of the equipment is given, with a general description of the circuits. Eight microphones and five hundred pairs of headphones are catered for, and provision is made for various recorders and for broadcasting.

621.395.613.32 **2458**

Microphones : Part 3 (cont.).—S. W. Amos & F. C. Brooker. (*Electronic Engng*, July 1946, Vol. 18, No. 221, pp. 221–223.) A description of various makes of microphone of the moving coil, condenser, and piezoelectric types, and of their equivalent circuits, including the acoustic networks incorporated to maintain an even response curve. A polar diagram for a typical pressure-operated microphone shows variation of directional properties with frequency. For parts 1 and 2 see 1755 of July ; for part 3(a) see 2120 of August.

621.395.614 **2459**

Sound - Pressure Measurement Standard. — F. Massa. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 218..228.) A microphone comprising a pile of piezoelectric crystal plates in a rigid housing has wider frequency and dynamic ranges than other microphones generally available for making absolute sound measurements.

621.395.623.54 : 621.395.92 **2460**

A New Earpiece [for deaf-aid equipment]. — C. M. R. Balbi. (*Wireless World*, June 1946, Vol. 52, No. 6, p. 179.)

621.395.623.7 **2461**

Corner [loudspeaker] **Deflector Baffles.**—(*Wireless World*, June 1946, Vol. 52, No. 6, p. 181.) The walls of the room housing the loudspeaker are used as elements in the combined horn and baffle system. Two outward radiating paths of logarithmically increasing section are produced, and a diffuser is incorporated to give even distribution of high frequencies. There is ample bass response, and the full rated power is delivered without any signs of overloading. A short illustrated description of the system.

621.395.625.2 **2462**

Embossing Sound on Film.—S. Kempner. (*Radio News*, June 1946, Vol. 35, No. 6, pp. 36..108). A general description of the Recordgraph and its performance. See also 537 of March.

621.395.625.3 **2463**

The German Magnetophon.—R. A. Power. (*Wireless World*, June 1946, Vol. 52, No. 6, pp. 195–197.) A description of the magnetic recording equipment in which the medium is a polyvinylchloride strip impregnated with an equal weight of finely powdered magnetic Fe_2O_3. Compared with other tape or wire recorders the equipment offers (*a*) better quality (25–10 000 c/s, dynamic range about 70 db with 2% distortion), (*b*) a lighter, tougher, and cheaper medium, (*c*) easy cutting and splicing of the tape, (*d*) facility for writing notes, titles, etc., along the roll. See also 834 of April and back references.

621.395.645.3 **2464**

Additional Notes on the Parallel Tube Amplifier.—F. C. Jones : J. Velasco. (*Radio, N.Y.*, June 1946, Vol. 30, No. 6, pp. 26..38.) Notes on an experimental high-fidelity amplifier with a parallel-tube output and separate high- and low-frequency tone controls. Follows a previous paper on the subject, 263 of February (Jones). A comment on the latter by Velasco is included.

621.395.82 : 621.395.645 : 621.317.79 **2465**

Measuring Audio Intermodulation.—Pickering. (*See* 2641.)

621.396.667 **2466**

Low-Frequency Correction Circuit.—(*See* 2532.)

621.396.667 **2467**

Tone Correction.—Gregory. (*See* 2533.)

AERIALS AND TRANSMISSION LINES

621.392 **2468**

On the Calculation of the Radiation Field of a Waveguide.—N. Maloff. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, No. 6, pp. 224–225.) In calculating the field at the open end of a waveguide from Kirchhoff's formula it is usual to assume that the configuration of this field is the same as that of the field inside an infinitely long waveguide. In the present paper the validity of this assumption for the H_{01} mode in a cylindrical guide is examined by checking whether the ratio A_2/A_1 remains equal to unity for all values of the ratio λ/λ_0 ($= \Lambda$), where A_1 is the energy flux through the cross-section of the waveguide, A_2 the energy flux through a sphere at the centre of which the opening of the waveguide is located, λ the free-space operating wavelength, and λ_0 the critical wavelength. The calculated results, which are collected in a table, throw considerable doubt on the validity of the assumption, particularly in the region of most practical interest, *i.e.* when $\lambda/\lambda_0 > 0.8$.

621.392 **2469**

On the Propagation of Electromagnetic Waves in Curved Pipes.—M. Jouguet. (*C. R. Acad. Sci., Paris*, 18th Feb. 1946, Vol. 222, No. 8, pp. 440–442.) A theoretical analysis of a curved guide of circular cross-section excited in the E_0 and H_0 modes. It is concluded that for E_0 the curve causes no change in phase velocity and that the E and H fields are not orthogonal. Analysis for H_0 gives incompatible equations, from which it is concluded that waves cannot be propagated in this mode.

621.392 **2470**

Wave Guide Transmission Systems.—T. Moreno. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 136–141.) A sequel to 2136 of August. A discussion of the attenuation and standing waves produced by various joints and bends used in waveguides. If the inner radius of a bend is greater than a guide wavelength λ_g, the voltage standing wave ratio produced will be under 1.05. A rectangular guide of length $2\lambda_g$ or more, twisted by 90° about its axis, will introduce a s.w.r. generally less than 1.1. Graphs showing the required dimensions of corner connectors for minimum reflection are given, and couplings, tee-joints, matching diaphragms, and coaxial-line transformers discussed.

621.392.2 **2471**

Propagation along a Line having only Distributed Resistance and Capacitance which are Functions of Position but have a Particular Relationship to Each Other.—M. Parodi. (*C. R. Acad. Sci., Paris*, 3rd Sept. 1945, Vol. 222, No. 10, pp. 257–259.) A mathematical paper. For a particular relationship between C and R, given in the paper, the differential equation can, by change of variable, be transformed to one with constant coefficients and solved explicitly.

621.392.2 **2472**

Remarks on the Equations of Propagation on any Line. — F. Raymond. *C.R. Acad. Sci., Paris*, 4th April 1945, Vol. 220, No. 14, pp. 497–500.) A mathematical paper. It gives formally the solution for the propagation of any disturbance along a transmission line of which the characteristics L, C, R, and G are functions of the distance along the line.

621.392.2 **2473**

Propagation along any Polyphase Symmetrical Line.—M. Parodi & F. Raymond. (*C.R. Acad. Sci., Paris*, 9th April 1945, Vol. 220, No. 15, pp. 522–523.) A very general formal matrix analysis of a symmetrical system of *n* lines with non-uniform characteristics.

621.392.2 **2474**

Transmission Problems.—R. H. Paul. (*Electrician*, 26th April & 3rd May 1946, Vol. 136, Nos. 3543 & 3544, pp. 1097–1099 & 1165–1167.) A discussion of " some rigorous methods of solving problems connected with long transmission lines without having recourse to hyperbolic functions of complex angles or convergent series."

621.392.2 **2475**

Some Novel Expressions for the Propagation Constant of a Uniform Line.— J. L. Clarke. (*Bell Syst. tech. J.*, Jan. 1946, Vol. 25, No. 1, pp. 156–157.) By a simple extension of well-known equations for the characteristics of a line, the attenuation constant is expressed in terms of the electrostatic and electromagnetic energies per unit length of line, and the characteristic impedance is expressed in terms of the phase velocity.

621.392.2 **2476**

Propagation Characteristics of a Uniform Line.—I. F. Macdiarmid & H. J. Orchard. (*Wireless Engr*, June 1946, Vol. 23, No. 273, pp. 168–171.) A geometrical method of deriving the real and imaginary components of the propagation constant of a uniform transmission line is give The form of the expressions thus derived is such as to indicate the physical significance of the different line parameters.

621.392.2 **2477**

Simplified Input Impedance Chart for Lossless Transmission Lines.—L. Mautner. (*Communications*, May 1946, Vol. 26, No. 5, pp. 44–45, 63.) A chart giving the range of input impedance for lines of length $n\lambda/8$ terminated resistively and reactively.

621.392.2 : 621.396.61 **2478**

Transmission Lines as Resonant Circuits.—L. R. Quarles. (*Communications*, May 1946, Vol. 26, No. 5, pp. 22..52.) Formulae for calculating the dimensions for any reactance using either coaxial or twin lines, with some examples of their application. Part 1 of a 3-part series, for part 2 see 2480 below.

621.392.43 **2479**

Graphical Calculation of Double Stubs.—R. C. Paine. (*Radio, N.Y.*, June 1946, Vol. 30, No. 6, pp. 23–25..37.) Circle diagrams, together with a parabolic locus defining the admittance of stubs, can be used to solve double-stub transmission-line matching problems. The diagrams are given, and examples are worked out.

621.392.52 **2480**

Transmission Lines as Filters.—L. R. Quarles. (*Communications*, June 1946, Vol. 26, No. 6, pp. 34..48.) The design of filters for the following types of application are considered : (*a*) suppression of unwanted r.f. harmonics on transmission lines, by means of a shunt stub ; (*b*) band-pass intercircuit coupling with filters of T configuration ; (*c*) wide-band matching filters. Part 2 of a series beginning with 2478 above.

621.396.67 **2481**

Coaxial Feed F.M. Loop Antennas.—A. G. Kandoian. (*Electronic Industr.*, May 1946, Vol. 5, No. 5, pp. 74..126.) Paper based on 1180 of May by the same author.

621.396.671 : 621.396.822 **2482**

Fluctuation Noise in a Receiving Aerial.—Burgess. (*See* 2699.)

621.396.674 **2483**

Inductive Tuned Loop Circuits : Parts 1 & 2.—W. J. Polydoroff. (*Radio, N.Y.*, April & May 1946, Vol. 30, Nos. 4 & 5, pp. 21–22 & 20–22.) The advantages of permeability-tuned loop aerials in respect of signal/noise ratio and directional discrimination against interference are described. The need for balancing and shielding the loop to obtain these advantages is explained.

621.396.674 : 621.317.79 **2484**

An Improved Method of Testing Loop Receivers.—W. J. Polydoroff. (*Radio, N.Y.*, June 1946, Vol. 30, No. 6, pp. 15–17, 36.) A single-wire transmission line is strung across a screened room. One end of the line is connected to a signal generator, the other is terminated with its characteristic impedance. The radiation simulates the field of a horizontally propagated vertically polarized wave. The receiver loop under test is supported underneath the transmission line.

621.396.674 : 621.318.323.2.029.5 **2485**

Iron-Cored Loop Receiving Aerial.—R. E. Burgess. (*Wireless Engr*, June 1946, Vol. 23, No. 273, pp. 172–178.) " The complex effective permeability of a mass core is expressed in terms of the relevant factors, and the imaginary part is related to the eddy current loss in the particles, which should predominate over other components of loss.

" The increase of pick-up due to a spheroidal core is calculated and it is shown that the core should be elongated in a direction parallel to the axis of the loop. The effect of a hollow spheroidal core is discussed and it is found that in a typical case 80 per cent of the iron can be removed before the increase of pick-up is halved ; the effect of spacing the winding from the core is treated approximately.

" Recommendations are made regarding the design for maximum sensitivity."

An editorial comment (G. W. O. H.) appears in the same journal, pp. 156–157.

621.396.677 **2486**

Radar Technique.—W. T. C. (*Wireless World*, May 1946, Vol. 52, No. 5, pp. 151–154.) A review of papers on waveguide and aerial techniques presented at the I.E.E. Radiolocation Convention.

621.396.677 **2487**

A Current Distribution for Broadside Arrays which Optimizes the Relationship between Beam Width and Side-Lobe Level.—C. L. Dolph. (*Proc. Inst. Radio Engrs, W. & E.*, June 1946, Vol. 34, No. 6, pp. 335–348.) " A one-parameter family of current distributions is derived for symmetric broadside arrays of equally spaced point sources energized in phase. For each value of the parameter, the corresponding current distribution gives rise to a pattern in which (1) all the side lobes are at the same level ; and (2) the beam width to the first null is a minimum for all patterns arising from symmetric distributions of in-phase currents none of whose side lobes exceeds that level."

Design curves expressing both the value of the parameter and the relative current values as functions of side-lobe level are given for the cases of 8-, 12-, 16-, 20-, and 24-element linear arrays.

621.396.677 **2488**

Long-Wire Antennas.—W. V. B. Roberts. (*QST*, June 1946, Vol. 30, No. 6, pp. 36–39.) A simplified qualitative treatment of the operation of rhombic and V aerials. The power gains of the rhombic and the half-wave dipole are compared.

621.396.677 + 621.396.61].029.63 **2489**

CQ 2 400 Mc/s : Transceivers and Antennas for the 13-Centimeter Band.—Koch & Floyd. (*See* 2758.)

621.396.677.029.64 **2490**

Radio Lenses.—W. E. Kock. (*Bell Lab. Rec.*, May 1946, Vol. 24, No. 5, pp. 193–196.) The phase velocity of a radio wave propagated between parallel metal plates is greater, on waveguide principles, than the velocity of propagation in free space. A pile of equally spaced parallel plates therefore acts like a block of material with refractive index less than that of free space. Converging lenses have been made by shaping the edges of the plates in such an array to the profile of a concave lens. A general description of the principle and illustrations of lenses are given. Beams 0.1° wide have been obtained. Other possible applications of the principle are mentioned.

621.392 **2491**

Problèmes de Propagations Guidées des Ondes Électromagnétiques. [Book Review]—L. de Broglie. Gauthier-Villars, Paris, 1941, 160 fr. (*Wireless Engr*, June 1946, Vol. 23, No. 273, p. 171.) " . . . a carefully prepared review of the subject. . ."

CIRCUITS

621.3.017 **2492**

Loss due to Shunt or Series Resistance Inserted between Matched Source and Sink.—(*Radio, N.Y.*, April 1946, Vol. 30, No. 4, p. 38.) A chart giving the loss as a function of the ratio of the shunt or series resistance to the load resistance.

621.314.2 **2493**

Equivalent Capacitances of Transformer Windings.—W. T. Duerdoth. (*Wireless Engr*, June 1946, Vol. 23, No. 273, pp. 161–167.) " The paper shows that the distributed capacitances between windings, or windings and screens, of transformers may be represented by lumped capacitances provided that the magnetic coupling between the turns of a winding is perfect. Expressions have been obtained for the equivalent capacitances of a number of different arrangements including windings in layers, sections, and with screens."

621.316.722.078.3 : 621.392.5 **2494**

The Theory of the Non-Linear Bridge Circuit as Applied to Voltage Stabilizers.—G. N. Patchett. (*J. Instn elect. Engrs*, Part I, April 1946, Vol. 93, No. 64, pp. 189–190.) Long summary of 867 of April.

621.316.974 : 621.318.4.017.31 **2495**

Power Loss in Electromagnetic Screens.—Siocos. (*See* 2716.)

621.318.572 **2496**

Design and Use of Directly Coupled Pentode Trigger Pairs.—V. H. Regener. (*Rev. sci. Instrum.*, May 1946, Vol. 17, No. 5, pp. 180–184.) Discussion of a trigger circuit using two pentodes with direct plate to screen intercoupling. Comprehensive characteristic curves are given for a typical trigger using 6AK6 pentodes, showing the effect of biasing either the control or suppressor grids of one or both valves. Circuits for a pulse generator and an electronic switch are given, and the limits of input for successful operation are deduced from the curves. Another circuit, in which each suppressor is capacitively coupled to the screen of the same valve, may be used to obtain triggering with pulses of one sign only.

Scaling circuits up to scale of eight are briefly mentioned.

621.318.572 **2497**

Decade Counting Circuits.—V. H. Regener. (*Rev. sci. Instrum.*, May 1946, Vol. 17, No. 5, pp. 185–189.) A simple ring-of-ten counter designed round the directly coupled pentode trigger discussed in 2496 above. The essential characteristic of the circuit is that it has ten possible equilibrium conditions. Two detailed circuits are given, one of which will count sharp pulses up to a frequency of 10^5 c/s. The other will do the same for impulses of arbitrary shape and frequency. The number of pulses counted by each ring of ten may be indicated by the position of the spot on a cathode-ray tube. Multiplicity of circuits and tubes enables decimal counting to be obtained to any required number.

621.392.43 : 621.365.92 **2498**
Coupling Method for Dielectric Heating.—R. C. Kleinberger. (*Electronic Industr.*, June 1946, Vol. 5, No. 6, pp. 78–79.) The necessary impedance matching to obtain maximum power transfer from transmission line to load can be most conveniently obtained by the use of adjustable stubs. Procedure and equations are given whereby stubs may be designed to effect approximate tuning of the load impedance and matching of the transmission line. Final adjustments are determined by actual trial.

621.392.5 + 621.395.665 **2499**
Radio Design Worksheet: No. 47 — Bridged T and H Attenuators; Diode Conduction.—(*Radio, N.Y.*, April 1946, Vol. 30, No. 4, pp. 36–37.)

621.392.5 **2500**
Solving 4-Terminal Network Problems Graphically: Part 2. — R. Baum. (*Communications*, May 1946, Vol. 26, No. 5, pp. 40..53.) Further discussion of the Smith diagram and inversion charts, and an illustration of the technique by the solution of a problem containing tuned circuits, resistances, and lines. For part 1 see 1786 of July.

621.392.5 **2501**
Determination of a Class of Coupled Circuits with *n* Degrees of Freedom, having the same Natural Frequencies as a Given Assemblage of Coupled Circuits. — M. Parodi. (*C. R. Acad. Sci., Paris*, 28th Jan. 1946, Vol. 222, No. 5, pp. 281–283.) A mathematical paper. It derives formally, by matrix methods, the values of the circuit elements (L, C and R) for all members of a class of coupled circuits having the same natural frequencies as a given assembly of such circuits. The demonstration depends on the fact that the determinant of a product of matrices is equal to the product of the determinants of the matrices.

621.392.52 **2502**
Preferred Numbers and Filter Design. — P. Blanchet: H. Jefferson. (*Wireless Engr*, June 1946, Vol 23, No. 273, p. 179.) A comment, in French, on 3823 of 1945 (Jefferson) with Jefferson's reply. See also 871 of April (Jefferson).

621.392.52 **2503**
Filter Design Tables Based on Preferred Numbers: High-Pass Filters.—H. Jefferson. (*Wireless Engr*, July 1946, Vol. 23, No. 274, pp. 197–199.) Tables are given for the design of constant-*k* high-pass filters of T- or π-sections. See also 871 of April and 3823 of 1945 (Jefferson).

621.392.52 **2504**
A Tunable Rejection Filter.—R. C. Taylor. (*Trans. Amer. Inst. elect. Engrs*, May 1946, Vol. 65, No. 5, pp. 263–267.) The theory and design of a bridge-type narrow-band filter. Range of adjustment and effect of component variations are discussed with the aid of impedance circle diagrams. Approximate formulae for attenuation and bandwidth are deduced.

621.392.52 **2505**
Transmission Lines as Filters.—Quarles. (*See* 2480.)

621.394/.396].645 **2506**
Radio Design Worksheet: No. 48 — Reactive Feedback Factors.—(*Radio, N.Y.*, May 1946, Vol. 30, No. 5, p. 24.) Analysis of reactive feedback in an amplifying stage having an elliptical load line.

621.394/.397].645.2 **2507**
The Cathode-Coupled Amplifier.—K. A. Pullen, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, June 1946, Vol. 34, No. 6, pp. 402–405.) Further applications of the double-triode cathode-coupled circuit previously described by Sziklai & Schroeder (3811 of 1945), including its use as h.f. amplifier, multivibrator, a.f. and r.f. oscillators, resonant-resistance meter, and mixer circuit. Design data, including gain characteristics for a typical valve (6SN7), are given. See also 2157 of August (Crosby).

621.394/.397].645.2 **2508**
Wide-Band Amplifiers: Part 3.—(*Wireless World*, May 1946, Vol. 52, No. 5, pp. 161–162.) An analysis of band-pass coupling by critically coupled equally damped circuits, showing that the arrangement gives less gain for the same bandwidth than that of stagger-tuned circuits described in 1789 of July.

621.394/.397].645.29 **2509**
An Analysis of Cascode Coupling.—R. G. Middleton. (*Radio, N.Y.*, June 1946, Vol. 30, No. 6, pp. 19, 32.) A graphical analysis of a "cascode" amplifier based on the family of plate current curves. In this circuit the signal is applied equally to the grids of two amplifying valves, of which the cathode of one is connected directly to and in series with the anode of the other. The basic d.c. amplifier may be adapted for a.c.

621.394.645.35 : 621.317.715 **2510**
A Contact Modulated Amplifier to Replace Sensitive Suspension Galvanometers.—Liston, Quinn, Sargeant & Scott. (*See* 2629.)

621.394.645.35 : 621.383 **2511**
Direct-Current Amplifier for a Photocell with Low Insulation Resistance or Large Dark-Current.—J. Dubois. (*C. R. Acad. Sci., Paris*, 28th May 1945, Vol. 220, No. 22, pp. 768–770.) Note on a modification of the input circuit to a B405 amplifier valve that gives a substantial improvement of sensitivity by maintaining the operating point on the linear part of the characteristic.

621.395.645 + 621.396.621 **2512**
Superamp with Tuner.—C. G. Brennan. (*Radio Craft*, May 1946, Vol. 17, No. 8, pp. 539, 563.) Details of a high fidelity a.f. amplifier and superheterodyne receiver.

621.395.645 **2513**
Additional Notes on the Parallel Tube Amplifier.—Jones: Velasco. (*See* 2464.)

621.395.645 **2514**
Negative Feedback and Hum.—"Cathode Ray". (*Wireless World*, May 1946, Vol. 52, No. 5, pp. 142–145.) A series of experimental results is given for typical triode and pentode amplifier stages. It is concluded that (*a*) feedback from the anode, when

the load is transformer coupled, is generally bad practice unless the h.t. supply is very smooth; (*b*) with triodes, when feedback is generally not used, parallel feed should be used; (*c*) with tetrodes and pentodes, freedom from hum is obtained by smoothing the screen supply, or by use of feedback; (*d*) a transformer-coupled pentode is remarkably hum-free without feedback. See also 1477 of June (Builder).

621.395.645 : 534.43 **2515**

Unique Phono Amplifier.—C. E. Pett, Jr. (*Radio News*, May 1946, Vol. 35, No. 5, pp. 50..90.) Constructional details of an amplifier with circuits for bass and treble boost and for contrast expansion.

621.395/.397].645 : 621.314.25 **2516**

Phase Inverters.—H. A. Bustard. (*Radio News*, Feb. 1946, Vol. 35, No. 2, pp. 57..104.) Circuit diagrams of nine different types, with a detailed discussion of their design and operation.

621.395.645 : 621.317.733 **2517**

A Convenient Amplifier and Null Detector.—Scott & Byers. (*See* 2634.)

621.395.645 : 621.395.665.1 **2518**

A Volume Expander Compressor Preamplifier.—R. C. Moses. (*Radio News*, June 1946, Vol. 35, No. 6, pp. 32..149.) Constructional details of a preamplifier with a maximum overall gain of 110 db. The time delay of the automatic gain control can be adjusted to give a minimum rise time of 3 milliseconds, and maximum decay time of 500 milliseconds.

621.396.6.018.1 **2519**

Phase Relationships.—M. G. Scroggie: J. H. Barrett. (*Wireless World*, May 1946, Vol. 52, No. 5, pp. 170–171.) Critical discussion of 1794 of July (Cooper).

621.396.61 **2520**

Tuned Circuits for the U.H.F. and S.H.F. Bands.—F. C. Everett. (*Communications*, June 1946, Vol. 26, No. 6, pp. 19–21, 51.) A review of fixed and variable tuned circuits including a more detailed description of a symmetrical wide-band cylindrical circuit similar to those described in 1797 of July (Gross).

621.396.611 : 536.7 **2521**

Boltzmann's Law of Slow Transformation and the Theory of Electromagnetic Cavities.—T. Kahan. (*C. R. Acad. Sci., Paris*, 2nd Jan. 1946, Vol. 222, No. 1, pp. 70–71.) Derivation of a general formula for the Q of a cavity which "leads to new methods of determining dielectric constants, multiplication factors, and magnetic permeabilities at hyper-frequencies."

621.396.615 **2522**

A Study of Locking Phenomena in Oscillators.—R. Adler. (*Proc. Inst. Radio Engrs, W. & E.*, June 1946, Vol. 34, No. 6, pp. 351–357.) "Impression of an external signal upon an oscillator of similar fundamental frequency affects both the instantaneous amplitude and the instantaneous frequency. Using the assumption that time constants in the oscillator circuit are small compared to the length of one beat cycle, a differential equation is derived which gives the oscillator phase as a function of time. With the aid of this equation, the transient process of 'pull-in' as well as the production of a distorted beat note are described in detail.

"It is shown that the same equation serves to describe the motion of a pendulum suspended in a viscous fluid inside a rotating container. The whole range of locking phenomena is illustrated with the aid of this simple mechanical model."

621.396.615 **2523**

Notes on the Stability of LC Oscillators.—N. Lea. (*J. Instn elect. Engrs*, Part I, May 1946, Vol. 93, No. 65, pp. 235–236.) Summary of 569 of March.

621.396.615 : 621.396.611.21 + 621.317.361 **2524**

Series-Resonant Crystal Oscillators.—F. Butler. (*Wireless Engr*, June 1946, Vol. 23, No. 273, pp. 157–160.) Most crystal oscillators use the crystal in the parallel-resonant mode. Quartz crystals however possess a series resonant mode that has the advantage of somewhat higher constancy of frequency. The frequency, in the series mode, is unaffected by changes in parallel reactance (*e.g.* holder capacitance) but is affected by changes in series reactance. Circuits of the Hartley type are described in which the crystal is connected between the cathode of the valve and the centre of the oscillatory coil.

621.396.615.17 **2525**

Kinematic Definition of Relaxation Oscillations.—J. Abelé. (*C. R. Acad. Sci., Paris*, 9th April 1945, Vol. 220, No. 15, pp. 511–513.) Van der Pol (1930 Abstracts, p. 503) defined relaxation oscillations in terms of a nonlinear second-order differential equation. The present author calls this a "dynamic" definition, and proposes a "kinematic" definition analogous to the definition of sinusoidal oscillations as the projection of a circular motion. Consideration is given to the projection of the end of a uniformly rotating vector on an axis that oscillates according to a fixed law relative to the rotation. "The curves so obtained are analogous to those of van der Pol who used a more laborious and less accurate method of graphical integration." A more detailed account is to appear elsewhere.

621.396.615.17 **2526**

Linear Saw-Tooth Oscillator.—W. T. Cocking. (*Wireless World*, June 1946, Vol. 52, No. 6, pp. 176–178.) A modification of the transitron timebase, operating with a single pentode, and essentially a combination of the pre-war transitron and the Miller integrator developed during the war. The control grid, cathode, and anode are used for the linearizing action, and the screen and suppressor grids are resistance-capacitance coupled to give a transitron type of circuit, thus providing a self-oscillating linear timebase.

621.396.619.16 : 621.396.9 **2527**

Radar Technique.—W. T. C. (*Wireless World*, May 1946, Vol. 52, No. 5, pp. 156–158.) Review of papers on pulse circuits presented at the I.E.E. Radiolocation Convention.

621.396.645 **2528**

Intermediate Frequency Amplifier Stability Factors.—D. L. Jaffe. (*Radio, N.Y.*, April 1946, Vol. 30, No. 4, pp. 26–27, 55.) The stability is determined by the plate-grid capacitance of the individual tubes, wiring, overall gain, and coupling between the input and output. The last is important for amplifiers with gains in excess of 80 db. It is shown, by considering the phase of the feedback current, that the maximum anode impedance for stability is $\sqrt{(2/g_m\omega_0C_{gp})}$ for a single tuned circuit, and $\sqrt{(2g_m/\omega_0C_{gp})}$ is the maximum stable gain. The corresponding figures for double tuned circuits critically coupled are $\sqrt{(0.79/g_m\omega_0C_{gp})}$ and $\sqrt{(0.79g_m/\omega_0C_{gp})}$. Values for the latter are shown in graphs against frequency for a number of commonly used valves.

621.396.645.3.029.58 **2529**

Long Leads aren't Necessary.—Shuart. (*See* 2772.)

621.396.66 **2530**

Clamping Circuits.—J. McQuay. (*Radio Craft*, May 1946, Vol. 17, No. 8, pp. 541..561.) "A clamping circuit maintains either the positive extreme or the negative extreme of a waveform within the limits of a desired reference level of voltage."

621.396.662.2.029.6 **2531**

V.H.F. Coil Design.—Meyerson. (*See* 2732.)

621.396.667 **2532**

Low-Frequency Correction Circuit.—(*Wireless World*, June 1946, Vol. 52, No. 6, pp. 199–200.) Design of a circuit giving a rising response characteristic at the lower frequencies, such as is required for gramophone reproduction: the circuit also gives a small amplification.

621.396.667 **2533**

Tone Correction.—L. Gregory. (*Wireless World*, June 1946, Vol. 52, No. 6, p. 204.) Brief description of a circuit combining bass and treble boost with negative feedback.

621.397.645.2 : 621.396.621.54 **2534**

I.F. Amplifiers in Television Receivers.—M. H. Kronenberg. (*QST*, June 1946, Vol. 30, No. 6, pp. 62–65.) Circuits are given for two 12.75-Mc/s amplifiers with 2.5-Mc/s and 4-Mc/s bandwidth respectively, having attenuation at the 8.25-Mc/s sound channel. Design formulae are discussed.

621.392 **2535**

Heaviside's Electric Circuit Theory. [Book Review]—H. J. Josephs. Methuen & Co., London, 115 pp., 4s. 6d. (*Wireless Engr*, July 1946, Vol. 23, No. 274, p. 200.) One of the Monographs on Physical Subjects. "... a valuable addition to the Heaviside literature."

GENERAL PHYSICS

535.343.4 + 621.317.1.011.5 + 621.396.11.029.64] : 546.171.1 **2536**

Ammonia Spectrum in the 1 cm Wavelength Region.—Bleaney & Penrose. (*See* 2662.)

535.43 : 537.122 **2537**

On the Theory of the Scattering of Light on Free Electrons.—M. Al'perin. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, Nos. 1/2, pp. 3–13.) The existing methods for studying the problem are valid for small intensities of the incident wave only. It is possible, however, by choosing suitable variables to find an exact solution of the Dirac equations for an electron in the field of a plane wave. This is done in the present paper, and the solution found (17) is used to derive a formula (47) similar to the one obtained by Klein & Nishina (1929 Abstracts p. 588) but applicable to large intensities of the incident radiation and taking into account the possibility of a simultaneous absorption of several quanta. The results obtained are discussed in the light of quantum electrodynamics.

535.5 **2538**

A Graphical Method for determining the Refractive Index and Thickness of Thin Films.—I. Obreimoff. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, Nos. 10/11, pp. 431–438.) It is assumed that the film has a uniform thickness h and a constant refractive index n_2, and that a plane wave falls on the film at an angle i_1. If, under these conditions, E_p and E_s denote respectively the component of the electric vector in the plane of incidence and the component perpendicular to it, then $E_p{}^r$ and $E_s{}^r$ in the reflected wave will be reflected differently, *viz.*, $E_p{}^r = \rho_p E_p$ and $E_s{}^r = \rho_s E_s$. Moreover there will be a phase difference δ between these components. A system of equations (2) determining the relationship between ρ_s, ρ_p and δ was derived by Vlasoff who also pointed out that if γ and δ are determined experimentally ($\rho_p\,\rho_s = \tan\gamma$), then h and n_2 can be calculated from equations (2). With the many measurements required, however, the calculations would be too laborious, and a number of nomograms are given in order to simplify these, as well as those required in the measurements of γ and δ. Numerical examples are worked out, and the accuracy of the method is estimated.

536.7 : 621.396.611 **2539**

Boltzmann's Law of Slow Transformation and the Theory of Electromagnetic Cavities.—Kahan. (*See* 2521.)

537.226 **2540**

The Theory of the Polarization of Dipole Liquids in Strong Electric Fields.—A. Anselm. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, No. 9, pp. 364–369.) It was shown by the author in previous papers (*Zh. eksp. teor. Fiz.*, 1942, Vol. 12, p. 274, & 1943, Vol. 13, p. 432) that the theory of the inner field proposed by Debye for interpreting the polarization of dipole liquids in weak fields is incorrect. The same considerations also apply to Debye's theory of polarization in strong fields. In the present paper the author develops a new theory from the method used by Kirkwood (*J. Chem. Phys.*, 1939, Vol. 7, p. 911) investigating the polarization in weak fields. It is pointed out, however, that Kirkwood, having derived formula (1) for determining the permittivity ϵ in a weak field has attempted to calculate M_∞, the electric moment appearing in an infinite dielectric with a fixed orientation of one of its molecules. Such attempts are bound to fail with the present state of knowledge of intramolecular forces in a liquid, so the author proposes to treat M_∞ as a parameter which characterizes the molecular interaction, and which can be determined experimentally. Accordingly, a formula (14) is derived for calculating the dielectric constant ϵ' in strong fields. It is possible to check the new theory experimentally by considering other phenomena determined quantitatively by M_∞. Thus it is shown that the value of $(\epsilon' - \epsilon)/\epsilon$ depends on M_∞. A comparison between the theoretical and experimental values of the ratio for water and nitrobenzene indicates that the theoretical results are of the correct order of magnitude.

537.312.62 **2541**

Notes on the Theory of Superconductivity.—V. Ginsburg. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, No. 5, pp. 134–151.) The theory is discussed in the light of the latest experimental and theoretical investigations under the following headings: (*a*) main properties of superconductivity; (*b*) phenomenological electrodynamics; (*c*) microscopic aspect of superconductivity; (*d*) energy spectrum and properties of the electron liquid; (*e*) statistical and some other properties of superconductors.

The main conclusion reached is that the theory of superconductivity is closely associated with the electron theory of metals in a normal state. Efforts therefore should be directed towards further development of the latter theory, but on the basis of the electron liquid concept, *i.e.* without using the electron gas hypothesis.

A list of 16 references is given.

537.525 : 535.34 **2542**

On the Absorption of Light by a Plasma.—A. Kompaneyets. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, No. 6, pp. 171–176.) It is known that free electrons do not absorb light. It would therefore appear that a completely ionized gas at a sufficiently high temperature would have a very low absorption coefficient. To verify this a mathematical investigation of the propagation of electromagnetic oscillations in a plasma is presented. It is shown that owing to the forces acting between the electrons and the positive ions of the plasma the latter possesses a considerable absorption coefficient. This absorption, as distinct from the photoelectric absorption, does not decrease with the frequency of the light wave and the temperature of the plasma. A formula (37) is derived determining the absorption coefficient, and methods are indicated for carrying out the necessary calculations.

538.222 : 538.56 **2543**

A New Method for Investigating Paramagnetic Absorption.—S. Altschüler, E. Zavoiski & V. Kozirev. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, Nos. 10/11, pp. 407–409.)

538.3 **2544**

Electromagnetic Field Equations for a Conducting Medium with Hysteresis.—M. Rozovski. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, Nos. 10/11, pp. 402–406.) In Maxwell's equations, it is usually assumed that $B(z, t) = \mu H(z, t)$. If, however, the magnetic lag is taken into account, the latter formula must be so modified as to reflect the dependence of $B(z, t)$, not only on the value of $H(z, t)$ at the given moment, but also on the states of $H(z, t)$ preceding this moment. Using the relationship (3) between $B(z, t)$ and $H(z, t)$, introduced by Volterra, an integral-differential equation (11) of a more general character is derived from Maxwell's equations. It is shown that this equation can be solved by the Fourier method.

538.31 **2545**

Two Electromagnetic Problems.—G. W. O. H. (*Wireless Engr*, July 1946, Vol. 23, No. 274, pp. 181–182.) If a current-carrying solenoid, placed in a magnetic field from a source remote from the solenoid, is reversed in direction, the reduction of magnetic energy within the solenoid is balanced by the increase outside it, and all the work done against the field appears as energy in the electric circuit.

538.31 **2546**

On the Parametric Oscillations of an Iron Body in an Alternating Magnetic Field.—S. Rytoff (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, No. 9, pp. 370–378.) An electromechanical system is considered consisting of a circular loop and an iron ball capable of moving along the axis of the loop. If a current is passed through the loop the ball will be attracted into the loop, and the coefficient of elasticity of the system for a current of frequency ω will vary between zero and maximum values with a frequency of 2ω. This is therefore an oscillating system with a periodically variable parameter determining its natural frequency, and, as is known, the equilibrium of such a system may become unstable under certain conditions.

A mathematical analysis of the system is offered, and equation (4) determining the appearance of oscillations is derived. It is shown that there are discrete regions of instability which can be reached by varying the strength of the loop current. A detailed description of experiments is given in which the following two types of oscillations were observed: (*a*) oscillations at the current frequency with small amplitudes and only slight nonlinearity; and (*b*) oscillations at fractional current frequencies with large amplitudes and a strongly pronounced nonlinearity. The parametric interaction between the loop current and eddy currents in the ball is also briefly discussed.

538.32 : 621.385.832 **2547**

Problem of Two Electrons.—R. E. Burgess: G. W. O. H. (*Wireless Engr*, June 1946, Vol. 23, No. 273, p. 178.) Discussion of 913 of April (G. W. O. H.). Burgess points out that the apparent paradox in the problem of two electrons is easily resolved by application of the principle of special relativity. G. W. O. H. replies editorially in the same journal, pp. 155–156. See also 587 of March (Tripp).

538.56 : 517.948.3 **2548**

The Boundary Problem of Electrodynamics and Integral Equations of Certain Diffraction Problems.—Ya. Feld. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, No. 9, pp. 330–341.) In a number of problems of electrodynamics it is required to determine the electromagnetic field set up by given exciters in a space bounded by metallic surfaces. Problems of this type can be reduced to the following: it is required to find, in a space v bounded by a surface s, a field with the tangential component of the electric vector vanishing at the surface s. In the present paper the case of harmonic oscillations only is considered, and a solution (1) of the problem is derived. The results obtained can be used to reduce some of the problems of electromagnetic diffraction to Fredholm's integral equations of the first kind. This is shown in a number of examples dealing with the diffraction of electromagnetic waves at an aperture in an infinite plane. Methods for solving the equations so derived are also indicated.

541.133 : [621.3.029.5/.6 **2549**

The Variation of the Electrical Conductivity of Electrolytes with Frequency.—N. Maloff. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, No. 6, pp. 221–223.) In a previous investigation (2682 of 1940) into the electrical conductivity of highly concentrated solutions of sodium chloride in water (up to 0.3 mol/litre) the author found a considerable decrease in the conductivity at high frequencies. In the present paper a mathematical analysis of the phenomenon is proposed based on a study of Belikoff (*Zh. eksp. teor. Fiz.*, 1939, Vol. 9, p. 969) of the movement of ions in electrolytes and on the conductivity of electrolytes at low frequencies. To simplify the discussion it is limited to the case of a symmetrical binary monovalent electrolyte, and it is shown that Belikoff's equations when extended to higher frequencies indicate a fall in the conductivity. In the case of low concentrations this becomes apparent at frequencies within the range of centimetre waves, while with high concentrations the effect begins to take place at frequencies of the order of 10^6 c/s. A physical interpretation of the results obtained is also given.

621.314.6 : 621.383.2 **2550**

Experimental Behaviour of a Photoelectric Cell under the Influence of an Alternating Potential of Very High Frequency.—Charles. (*See* 2725.)

621.314.6 : 621.383.2 **2551**

Theory of the Behaviour of a Photoelectric Cell under the Influence of an Alternating Potential of Very High Frequency.—Charles. (*See* 2726.)

621.314.63 + 621.315.34 **2552**

An Anomalous Phenomenon in Thermal Rectification in Lead Sulphide (Preliminary Communication).—Kh. Amirkhanoff. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, No. 6, pp. 193–194.) Experiments were conducted with lead sulphide obtained chemically in the form of a black powder. Samples at room temperature and a pressure of 10 000 kg/cm² possessed a hole-type conductivity, and a resistivity of 5.10^5 Ω cm. After heat treatment at 200–300°C, depending on the duration of the treatment, the resistivity decreased, and the hole-type conductivity was replaced by that of the electron type. In one sample, however, conductivity of the electron type changed again to the hole type after a current had passed for 30–60 sec. The phenomenon also occurred when the direction of the temperature gradient was changed. No residual polarization or other effects were observed. A table of the experimental data is given.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.7 + 525.24] : 551.51.053.5 **2553**

The Application of Solar and Geomagnetic Data to Short-Term Forecasts of Ionospheric Conditions.—A. H. Shapley. (*Terr. Magn. atmos. Elect.*, June 1946, Vol. 51, No. 2, pp. 247–266.) The ways in which recurrence tendencies of geomagnetic activity, reports of solar activity, and various solar-terrestrial relationships are used in preparing forecasts at the Dept. of Terrestrial Magnetism, Carnegie Institution of Washington. Forecasts are compared with magnetic activity over a 15-month period, and are 70% satisfactory. Analysis of coronagraphic and spectro-heliographic data with magnetic activity show that for two years there was a decided tendency for disturbances to occur when solar regions identified by these observations were east of the central meridian of the Sun. A minimum in solar activity occurred early in 1944 as indicated by reduction of solar and geomagnetic data.

Recorders have been constructed which give an instantly visible record of variation of the earth's magnetic field.

"Solar-geomagnetic relationships are still too general to be the sole factor in detailed forecasts. The manifestation, if any, of the solar cause of geomagnetic disturbance has not yet been found."

523.7 + 525.24] "1946.01/.03" **2554**

Solar and Magnetic Data, January to March 1946, Mount Wilson Observatory.—S. B. Nicholson & E. S. Mulders. (*Terr. Magn. atmos. Elect.*, June 1946, Vol. 51, No. 2, pp. 284–286.)

523.72 **2555**

The Solid Angle of the Corpuscular Solar Radiation.—M. N. Gnevishev & A.I.Ol. (*Terr. Magn. atmos. Elect.*, June 1946, Vol. 51, No. 2, pp. 163–170.) The solid angle may be evaluated by using data on (*a*) duration of magnetic storms; (*b*) equinoctial increase of geomagnetic activity; (*c*) correlation coefficients between magnetic activity and sunspot area in the central zone with different radii; (*d*) the lag of the 11-year variation of geomagnetic activity.

The researches indicate an angle of from 8° to 9°.

523.72 **2556**

A Theoretical Discussion of the Continuous Spectrum of the Sun.—G. Münch. (*Astrophys. J.*, Nov. 1945, Vol. 102, No. 3, pp. 385–394.) Experimental data are examined in relation to the theory of radiative equilibrium. The intensity distribution and the law of darkening in the different wavelengths can be explained in terms of the absorption coefficient. The required variation of this coefficient in the visual and near infra-red regions of the spectrum is also explained.

523.72 : 525.24 **2557**

Geomagnetic Data on Variations of Solar Radiation: Part 1—Wave-Radiation.—J. Bartels. (*Terr. Magn. atmos. Elect.*, June 1946, Vol. 51, No. 2, pp. 181–242.) Homogeneous time-series for **W** (a wave type of solar radiation) and **P** (a particle type) are derived from magnetic observations. Daily values for the deviations of **W** from a normal value are inferred from the variation of the horizontal intensity. These are compared with tables derived for the solar activity **R** and radiation **P**, the correlation for "slow" variations between **R** and **W** being well marked. "Fast" variations in **R** due to solar rotations are followed after a time lag by similar variations in **W**. The physical meaning of **W** and its extraction from geomagnetic records are discussed.

523.746 "1945" **2558**

Final Relative Sunspot-Numbers for 1945.—M. Waldmeier. (*Terr. Magn. atmos. Elect.*, June 1946, Vol. 51, No. 2, pp. 267–269.)

523.746 "1946.01/.03" **2559**

Provisional Sunspot-Numbers for January to March, 1946.—M. Waldmeier. (*Terr. Magn. atmos. Elect.*, June 1946, Vol. 51, No. 2, p. 274.)

523.746.5 **2560**

A Prediction of the Next Maximum of Solar Activity.—M. Waldmeier. (*Terr. Magn. atmos. Elect.*, June 1946, Vol. 51, No. 2, p. 270.) The maximum should be expected to take place as early as 1947.6. A table gives the smoothed monthly relative numbers for the epoch two years before to five years after the maximum.

523.78 : 525.23 **2561**

Atmospheric-Electric Potential-Gradient in Kokkola, Finland, during the Solar Eclipse of July 9, 1945.—E. Sucksdorff. (*Terr. Magn. atmos. Elect.*, June 1946, Vol. 51, No. 2, pp. 171–176.) Measurements were made using a bifilar electrometer and an ionium-collector. The eclipse caused a marked and smooth diminution of the potential gradient which began two hours prior to the beginning of the eclipse and continued even after the end of the visual eclipse.

523.78 : 551.51.053.5 : 621.396.11 **2562**

The Influence of an Eclipse of the Sun on the Ionosphere. — R. L. Smith-Rose. (*J. Brit. Instn Radio Engrs*, June 1946, Vol. 6, No. 3, pp. 82–97.) A survey of the structure of the ionosphere and its effects on propagation. The information gained from radio observations during solar eclipses is outlined. Experimental evidence shows that the main source of ionization is ultra-violet radiation from the sun; the possible contribution in the F_2 region from incident neutral particles is an open question. A more complete understanding is required of long-distance transmission, particularly at very low frequencies. A bibliography of 20 items is given.

533.6.013.22 **2563**

On Atmospheric Turbulence.—A. M. Obukhov. (*J. Phys., U.S.S.R.*, 1942, Vol. 6, No. 5, pp. 228–229.) Abstract of a paper of the Acad. Sci., U.S.S.R.

550.38 **2564**

Geomagnetic Secular Variations and Surveys.—J. A. Fleming. (*Proc. phys. Soc.*, 1st May 1946, Vol. 58, No. 327, pp. 213–246.)

550.38 "1945.07/.09" **2565**

Five International Quiet and Disturbed Days for July to September, 1945.—W. E. Scott. (*Terr. Magn. atmos. Elect.*, June 1946, Vol. 51, No. 2, p. 284.)

550.38 : 523.75 **2566**

Relations between Magnetic Disturbances and Solar Eruptions.—M. Burgaud. (*C. R. Acad. Sci., Paris*, 18th Feb. 1946, Vol. 222, No. 8, pp. 449–450.) Observations lead to the following conclusions: (*a*) magnetic storms do not depend on the size or growth of sunspots and faculae, but on violent eruptions; (*b*) a storm can be caused by an eruption on any part of the solar disk, but maximum effects are associated with eruptions near the central meridian; (*c*) magnetic disturbances have taken place in the absence of visible sunspots; they follow eruptions.

550.385 "1945.10/1946.03" **2567**

Principal Magnetic Storms [reported from various observatories].—(*Terr. Magn. atmos. Elect.*, June 1946, Vol. 51, No. 2, pp. 287–301.)

550.385 "1946.01/.03" **2568**

Geomagnetic Storms.—(*Curr. Sci.*, May 1946, Vol. 15, No. 5, p. 146.) A brief review of the more intense storms recorded at the Alibag Magnetic Observatory in the period January to March 1946.

550.385 "1946.03.23/.29" **2569**

Two Notable Geomagnetic Storms.—(*Nature, Lond.*, 6th April 1946, Vol. 157, No. 3988, p. 435. Reprinted *Terr. Magn. atmos. Elect.*, June 1946, Vol. 51, No. 2, pp. 283–284.)

550.385 "1946.03.28" **2570**

Geomagnetic Storm at Elisabethville, March 28, 1946.—W. E. Scott. (*Terr. Magn. atmos. Elect.*, June 1946, Vol. 51, No. 2, pp. 281–283.)

551.51.053.5 "1940/1944" **2571**

Annual Variation of the Values at Noon of the Critical Frequencies of the Ionized Layers at Tromsö during 1940, 1941, 1942, 1943, and 1944.—L. Harang. (*Terr. Magn. atmos. Elect.*, June 1946, Vol. 51, No. 2, pp. 275–277.) The monthly mean values show a continuous decrease for all three layers compared with those taken before 1940, the decrease being particularly pronounced for the F_2 layer.

LOCATION AND AIDS TO NAVIGATION

534.417 : 534.88 **2572**

Navy Releases Sonar Story.—(*See* 2452.)

551.576 : 621.383 **2573**

On Atmospheric [cloud-height] **Sounding.**—Barthélemy. (*See* 2657.)

621.396.674 : 621.318.323.2.029.5 **2574**

Iron-Cored Loop Receiving Aerial.—Burgess. (*See* 2485.)

621.396.677.1 **2575**

Aperiodic Combination of an Antenna and a Frame. Application in Direction-Finding to an Aperiodic Arrangement for Indicating Sense.—F. Carbenay. (*C. R. Acad. Sci., Paris*, 2nd Jan. 1946, Vol. 222, No. 1, pp. 63–64.) The potential difference at the terminals of a small resistance at the base of an aerial can be written $u = RCh\,dF/dt$ (R = resistance, C = aerial capacitance, h = effective height, F = vertical electrical intensity, t = time). The e.m.f. in the frame is $e = NS\,dH/dt$ (N = turns, S = area, H = horizontal magnetic intensity). The resultant of the two in series is zero or a maximum if $RChc = NS$ (c = velocity) which is a relationship independent of signal frequency. The arrangement is used in connexion with atmospheric locators.

621.396.9 **2576**

[I.E.E.] **Radiolocation Convention.**—(*Engineering, Lond.*, 29th March, 5th, 19th & 26th April 1946, Vol. 161, Nos. 4185, 4186, 4188 & 4189, pp. 306–308, 319–320, 367 & 389–390.) Summary of the proceedings. For other accounts see *Engineer, Lond.*, 29th March 1946, Vol. 181, No. 4707, pp. 296–297; *Radio, N.Y.*, May 1946, Vol. 30, No. 5, pp. 26..48; see also 1850 of July.

621.396.9 **2577**

Radar in War and Peace.—L. N. Ridenour. (*Elect. Engng, N.Y.*, May 1946, Vol. 65, No. 5, pp. 202–207.) The fundamental principles of radar, with brief notes on outstanding war-time achievements. The post-war possibilities of pulse navigation systems, radar beacons, and relay radar are discussed.

621.396.9 **2578**

Marine Radar for Peacetime Use.—L. H. Lynn & O. H. Winn. (*Trans. Amer. Inst. elect. Engrs*, May 1946, Vol. 65, No. 5, pp. 271–273.) Brief description of a commercial radar system for use on cargo vessels. Simplicity of operation for non-technical personnel is claimed.

621.396.9 **2579**

Radar for Blind Bombing : Part 2.—J. V. Holdam, S. McGrath & A. D. Cole. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 142–149.) The conclusion of 2196 of August, giving details, with circuit diagrams, of the modulators, scanners, r.f. systems, receiver-indicator systems, and synchronizers in the APQ-13 and APS-15 versions of the H2X equipment.

621.396.9 **2580**

Airborne Radar for Navigation and Obstacle Detection.—R. C. Jensen & R. A. Arnett. (*Trans. Amer. Inst. elect. Engrs*, May 1946, Vol. 65, No. 5, pp. 307–313.) An account of wartime achievements as a basis for peacetime applications.

621.396.9 **2581**

Early Fire-Control Radars for [U.S.] **Naval Vessels.**—W. C. Tinus & W. H. C. Higgins. (*Bell Syst. tech. J.*, Jan. 1946, Vol. 25, No. 1, pp. 1–47.) An account of the development in the Bell Telephone Laboratories of equipments " Mark I " to " Mark IV ". The first operated at 680–720 Mc/s using 2-kW pulses of adjustable duration 1–5 μs, repetition rate 1 640 p/s, obtained from a pair of " doorknob " valves (see 126 of 1938—Samuel). The aerial was an array of 8 half-wave dipoles in line with a parabolic cylinder reflector 6 ft square, giving a beam width of 12° and gain of 22 db. The receiver operated with 30-Mc/s i.f., 1-Mc/s bandwidth, and had a noise factor of 24 db. The equipment gave range to an accuracy of about ± 200 yd up to 10 miles or more, and azimuth to 1–2°.

The Mk II radar was superseded by Mk III before production began. Aerial lobe-switching was used in Mk III to give azimuth determination and tracking to ± 15 ft. A new type of range presentation gave an accuracy better than the requirement of ± 50 yd. A magnetron (W. E. 701-A) for 700 Mc/s, based on the 3-kMc/s British cavity type, gave 40-kW, 2-μs pulses, and the receiver, using " lighthouse " tubes for r.f. amplification, had a noise factor of 9 db, so that there was a substantial improvement of range. A gas-discharge (t.r.) switch was used for aerial duplexing (see 2784).

The Mk IV set had two aerial arrays one above the other, and used lobe-switching in elevation as well as azimuth, but was otherwise similar to Mk III.

All types were first installed in 1941.

621.396.9 : 534.321.9 **2582**

Ultrasonic [radar] **Trainer Circuits.**—F. J. Larsen. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 126–129.) A 15-Mc/s pulsed ultrasonic beam is projected in a water trough which has a special map made on its bottom surface with graduated surface roughening to represent terrain of different kinds. Sound waves reflected from the rough parts of the map are received by the crystal transducer and used to operate radar equipment. The beam is rotated, and the device is used to give p.p.i. presentation of the map. Auxiliary equipment is used to simulate aerial bombing runs. A general description is given, with details of some of the circuits.

621.396.9 : 621.317.79 **2583**

Techniques and Facilities for Microwave Radar Testing.—Green, Fisher & Ferguson. (*See* 2645.)

621.396.9 : 621.385.18 **2584**

The Gas-Discharge Transmit-Receive Switch.—Samuel, Clark & Mumford. (*See* 2783.)

621.396.9 : [621.396.11.029.64 + 538.569.4 **2585**

Radio Echoes from the Planets.—W. D. Hershberger. (*Science*, 22nd March 1946, Vol. 103, No. 2673, p. 371.) A note on the effect of absorption of microwaves by various gases. See also 1336 of May.

621.396.9 : 621.396.82 **2586**

Radar Countermeasures.—O. G. Villard, Jr. (*Proc. Radio Cl. Amer.*, March 1946, Vol. 23, No. 3, pp. 7–15.)

621.396.933 : 629.1.052 **2587**

Pulse-Type Radio Altimeter.—A. Goldman. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 116–119.) General description and circuit details of a high-altitude altimeter, designated SCR-718-C, that operates on the radar principle. The sine-wave output from a crystal-controlled oscillator is clipped, differentiated, and amplified in pulse-generating circuits to form the modulating signal for the 440-Mc/s transmitter, which provides 0.25-μs signals of 5–10 W. The cathode-ray indicator has a circular sweep, and the signals received directly from the transmitter and after ground reflection produce radial deflexions. The height is given by the angular separation of the deflexions. 5 000-ft and 50 000-ft scales are provided. Accuracy 50 ft.

621.396.933.23 **2588**

Use of Microwaves for Instrument Landing : Parts 2 & 3.—D. F. Folland. (*Radio, N.Y.*, April & May 1946, Vol. 30, Nos. 4 & 5, pp. 23–25, 55 & 16–19.) Further details of the Sperry blind-landing system. For part 1 see 1866 of July.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788.7 **2589**

Ionization Gauge Control Unit.—A. H. King. (*J. sci. Instrum.*, April 1946, Vol. 23, No. 4, p. 85.) A device for maintaining constant filament emission.

533.5 **2590**

An Apparatus for Stirring under Vacuum.—B. R. Atkins. (*J. sci. Instrum.*, April 1946, Vol. 23, No. 4, p. 84.)

533.5 : 621.3.032.53 **2591**

Coppered-Tungsten Seals through Hard Glass.—A. L. Reimann. (*J. sci. Instrum.*, June 1946, Vol. 23, No. 6, pp. 121–124.) The fine longitudinal cracks in tungsten wire which cause air leaks may be filled by plating the wire with Cu, with or without an added layer of Ni, and fusing the coating to the wire in a hydrogen furnace. The wire is then plated further with Cu and sealed into a glass with suitable properties depending on the diameter of the wire and the thickness of the plating.

535.37 **2592**

On the Inhibiting Effect of Oxygen on the Fluorescence of Solutions.—C. Chéchan. (*C. R. Acad. Sci., Paris*, 2nd Jan. 1946, Vol. 222, No. 1, pp. 80–82.)

535.37 **2593**

Note on the Behaviour of Zinc Sulphide Phosphors under Conditions of Periodic Excitation.—M. P. Lord & A. L. G. Rees. (*Proc. phys. Soc.*, 1st May 1946, Vol. 58, No. 327, pp. 280–289.) The effect of periodic excitation on luminescent solids and the electronic processes involved in the emission of luminescent radiation are examined theoretically, showing that the phase shift with respect to the exciting radiation and the ratio of the maximum to the minimum emitted intensities are the significant factors in the time function of the luminescent intensity. The variations of these parameters with intensity and period of excitation can be used to distinguish between the various mechanisms of the luminescent process, as is illustrated by an experimental examination of zinc sulphide and zinc cadmium sulphide phosphors. These phosphors show a semi-quantitative agreement with the characteristics of a simple ionization-recombination process, deviations from the theory being attributed to the activation of these phosphors by more than one type of activator atom.

535.37 **2594**

Note on the Rapid Determination of Decay Characteristics of Luminescent Solids.—M. P. Lord & A. L. G. Rees. (*Proc. phys. Soc.*, 1st May 1946, Vol. 58, No. 327, pp. 289–291.) Square-wave light pulses from a gaseous discharge tube, obtained by using a small vibrator to interrupt the d.c. supply to the tube, and used in conjunction with a cathode-ray display, afford a convenient and rapid method of investigation.

536.48 + 539.893 **2595**

Measurements at Low Temperatures and High Pressures: Part I.—Development of the Method for obtaining High Pressures at Low Temperatures.—B. Lazareff & L. Kahn. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, Nos. 10/11, pp. 439–447.) The method proposed is based on the fact that certain substances such as water, bismuth, antimony and gallium increase in volume during the transition from a liquid into a solid state. In a bomb containing such a substance high pressures can thus be generated and transmitted to a body immersed in it. Accordingly a bomb was developed (Fig. 2) utilizing water and intended for investigating superconductivity by the induction method. A description is also given of a simple device for accurate measurements of the pressure by observing the expansion of the bomb. Pressures of the order of 2 000 kg/cm^2 were obtained with this bomb at the liquid helium temperature. It is indicated that, with bismuth and gallium, pressures up to 10 000 kg/cm^2 would be possible.

536.55 **2596**

Temperature Indicating Compounds.—G. A. Williams. (*Electronic Engng*, July 1946, Vol. 18, No. 221, pp. 208–212.) An account, with coloured illustrations, of methods of estimating temperature by the use of (*a*) paints formulated to change colour at given temperatures in the range 80–800°C, and (*b*) compounds available in the form of crayons, emulsions, or pellets, which melt at sharply defined temperatures in the range 52–982°C.

537.226 **2597**

The Theory of the Polarization of Dipole Liquids in Strong Electric Fields.—Anselm. (*See* 2540.)

539.234 : 535.87 **2598**

Anti-Reflexion Films Evaporated on Glass.—J. Bannon. (*Nature, Lond.*, 6th April 1946, Vol. 157, No. 3988, p. 446.) Reflection from a glass surface may be reduced substantially by evaporating a metallic fluoride on to the surface. Magnesium fluoride is particularly suitable, and the results of various laboratory evaporation processes with this material are given.

620.197 : 621.357.7 : 669.55.6 **2599**

Corrosion-Resisting Properties of Electrodeposited Tin-Zinc Alloys.—R. M. Angles & R. Kerr. (*Engineering, Lond.*, 29th March 1946, Vol. 161, No. 4185, pp. 289–292.) Alloys with tin content varying from 0 to 100% were tested on iron and steel. The 78% alloy gives the greatest protection and is able to withstand a reasonable amount of deformation by bending or cupping.

621.314.63 + 621.315.34 **2600**

An Anomalous Phenomenon in Thermal Rectification in Lead Sulphide (Preliminary Communication).—Amirkhanoff. (*See* 2552.)

621.314.63 + 621.315.34 **2601**

The Asymmetry of Conductivity in Electronic Semiconductors.—Kh. Amirkhanoff. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, No. 6, pp. 187–192.) The following factors are enumerated, with which the appearance of the asymmetry is associated: (1) difference in the shape of the two contacts (plane, needle); (2) difference in the specific conductivity of the two electrodes; (3) temperature gradient.

Experimental data supplemented by the author's own experiments are surveyed, and the theoretical implications of each of the above factors discussed. The effects of combining several of these factors are then considered under the following headings: (*a*) Contact between a metallic needle and a crystal.—Heat is generated at the point of the contact, and thus both factors 1 and 3 are effective in this case. The two effects are cumulative or oppose each other according to the type of conductivity of the semiconductor (electrons, holes). (*b*) Solid plate rectifiers.—No definite indication is available as to whether factors 1 and 3 are co-existent in this case with factor 2. (*c*) Thermal rectification.—This is effective simultaneously with factors 1 and 2. It is pointed out that in the case of copper oxide thermal rectification can only take place when there is a high-resistance layer on the electrode. This is proved by a number of experiments in which copper-oxide plates were etched by nitric acid. The results of these experiments given in table 2 show that thermal rectification becomes negligible in plates with polished surface.

621.314.632 **2602**

The Effect of Temperature Gradient on the Rectifying Action of Copper Oxide Rectifiers.—Kh. Amirkhanoff. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, No. 6, pp. 195–201.) Experiments were conducted with plates of various types with facilities for varying the temperature at both sides of the plate within a range −15 to 150°C. The apparatus used is described, and the results obtained are shown in three tables. The main conclusion reached is that heating the upper electrode (oxide) and cooling the lower (copper) considerably improves the rectifying action. At the same time the sensitivity of the plate is also raised. It appears that under these conditions the thermal rectification is superimposed on the normal rectifying process. It is therefore suggested that in practice provision should be made for cooling only the copper surface of the rectifier elements. This would not only decrease the forward resistance, but also raise the permissible current density, as shown by Sharavski (307 of 1938).

Some of the results obtained in these experiments are also discussed from the point of view of an investigation of the barrier layer in copper-oxide rectifiers by means of a thermal sonde, reported by the author elsewhere.

621.315.59 : 621.396.822 **2603**

Voltage Fluctuations in Electronic Semi-Conductors.—B. I. Davidov. (*J. Phys., U.S.S.R.*, 1942, Vol. 6, No. 5, p. 230.) A general formula for the square of the voltage fluctuation is given, which reduces to the expressions for shot effect and Johnson effect under appropriate conditions. Abstract of a paper of the Acad. Sci., U.S.S.R.

621.315.61 : [621.315.2/.3 **2604**

Insulated Wire and Cable in Communications Today.—A. P. Lunt. (*Communications*, June 1946, Vol. 26, No. 6, pp. 30, 53.) The paper is concerned with available insulating materials, their properties and use in radio applications. Recommended types of insulation for a wide range of applications are given in tables.

621.315.611 **2605**

The Electrical Strength of Solid Solutions and their Melting Temperature.—N. Bogdanova. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, Nos. 1/2, pp. 30–31.) A report of an experimental investigation. Data obtained by von Hippel (1186 of 1938) were used to plot the curves in Fig. 1 (system KCl—RbCl: system KCl–KBr also behaves in a similar manner) and Fig. 2 (system NaCl—Ag Cl). In the first case the maximum electrical strength is obtained with a melting temperature of the order of 750°C. In the second case there is a linear decrease in electrical strength with increase in melting temperature. Systems KI–NaI and KI–KBr were also investigated, and the results are plotted in Figs. 3 and 4 respectively. It appears that the electrical strength of these solutions increases with the melting temperature. The effect of the composition of solid dielectric solutions was also investigated, but no sharp strengthening of the dielectric with the introduction of admixtures was observed.

621.316.86 : 546.281.26 **2606**

Silicon Carbide [non-ohmic] **Resistors.**—F. Ashworth, W. Needham & R. W. Sillars. (*Engineering, Lond.*, 29th March 1946, Vol. 161, No. 4185, p. 295.) Summary of an I.E.E. paper. See also 1885 of July.

621.318.22/.23 **2607**

Modern Hard Magnetic Materials.—K. Hoselitz. (*J. sci. Instrum.*, April 1946, Vol. 23, No. 4, pp. 65–71.) A survey of the preparation and properties of the alloys, and data for the design of permanent magnets made with them.

621.318.322.029.54/.64 **2608**

The Permeability of Ferromagnetic Materials at Frequencies between 10^5 and 10^{10} c/s.—J. T. Allanson. (*J. Instn elect. Engrs*, Part I, May 1946, Vol. 93, No. 65, pp. 234–235.) Summary of 645 of March.

621.318.323.2.029.3 **2609**

Study of Ferromagnetic Cores exposed to Sinusoidal Induction [frequencies up to 10 kc/s].—I. Épelboim. (*C. R. Acad. Sci., Paris*, 30th April 1945, Vol. 220, No. 18, pp. 651–653.)

621.38/.39](058.7) **2610**

1946 Electronic Engineering Directory.—(*Electronic Industr.*, May 1946, Vol. 5, No. 5, 48 pp., following p. 96.) A directory of American sources of supply of electronic and radio equipment and materials.

621.386.1 : 548.73 **2611**

X-Ray Studies of Surface Layers of Crystals.—E. J. Armstrong. (*Bell Syst. tech. J.*, Jan. 1946, Vol. 25, No. 1, pp. 136–155.) When a crystalline substance is sawn, ground, lapped, or polished, the crystal structure adjacent to the worked surface is distorted, and the disturbance is detectable by X-ray diffraction. A single crystal spectrometer, in which the intensity of reflection of X rays by the surface is measured, can be used to detect highly distorted layers. Less distorted surfaces can be detected by means of a double crystal spectrometer or by photography of X rays transmitted through the crystal. In quartz crystals, the amount of misorientation is mainly of the order of a minute of arc, but some material may be misoriented by three or four degrees. In addition there is usually some randomly oriented powder which can be detected only by electron diffraction. The distorted layers may be removed by etching. The paper reviews the appropriate X-ray techniques, and gives examples of their application. 38 references are given.

669.231.635.8 : 621.326.21 **2612**

Welding Small Platinum Heaters and Electrodes.—A. R. Morris. (*J. sci. Instrum.*, April 1946, Vol. 23, No. 4, p. 84.) Simple device to facilitate hammer welding of thin platinum wire or foil.

621.793 **2613**

Metallizing Non-Conductors. [Book Review]—S. Wein. Metal Industry Pub. Co., New York, 62 pp., $2.00. (*Electronics*, May 1946, Vol. 19, No. 5, p. 324.) A survey of commercial methods of forming metallic films on almost any type of surface, including chemical formulae and detailed procedures.

MATHEMATICS

517.92 : 518.42 : 531.721 **2614**

Simple Differential Equations arising in Physics; Rapid Solution by using Hatchet Planimeters.—A. Callender. (*J. sci. Instrum.*, April 1946, Vol. 23, No. 4, pp. 77–81.)

517.947.44 **2615**

On the Near-Periodicity of Solutions of the Wave Equation : Part 3.—S. L. Soboleff. (*C. R. Acad. Sci. U.R.S.S.*, 10th Oct. 1945, Vol. 49, No. 1, pp. 12–15. In French.) For parts 1 and 2 see 1901 & 1902 of July.

518.5 **2616**

A Slide Rule for the Addition of Squares.—W. E. Morrell. (*Science*, 25th Jan. 1946, Vol. 103, No. 2665, pp. 113–114.) Instructions for making a slide rule for solving problems of the form $d = (x^2 + y^2 + \ldots)^{\frac{1}{2}}$.

518.6 **2617**

On Relaxation Methods: a Mathematics for Engineering Science.—R. V. Southwell. (*Proc. roy. Soc. A*, 21st Aug. 1945, Vol. 184, No. 998, pp. 253–288.) Review of a powerful method for obtaining approximate solution of boundary value problems (*e.g.* Laplace's or Poisson's equation), illustrated by application to various mechanical and electrical systems.

533.56 : 517.948.3 **2618**

The Boundary Problem of Electrodynamics and Integral Equations of Certain Diffraction Problems.—Feld. (*See* 2548.)

538.3 **2619**

The Transformation of the Integral of Retarded Potentials to the Liénard-Wiechert Formulae.—E. Durand. (*C. R. Acad. Sci., Paris*, 28th Jan. 1946, Vol. 222, No. 5, pp. 284–286.) The derivation is based on Jacobi's theorem on the changing of variables in definite integrals.

518.2 **2620**

Circular and Hyperbolic Functions, Exponential and Sine and Cosine Integrals, Factorial Function and Allied Functions, Hermitian Probability Functions (British Association Mathematical Tables, Volume I). [Book Review] — Cambridge Univ. Press, London, 2nd edn. 1946, 72 pp., 10s. (*Proc. phys. Soc.*, 1st May 1946, Vol. 58, No. 327, pp. 339–340.)

MEASUREMENTS AND TEST GEAR

621.317.1 : 621.396.621.029.6 **2621**

V.H.F. Receiver [selectivity] **Measurements.**—H. Gordon & L. George. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 214..218.) Most v.h.f. signal generators have frequency scales that are too coarsely calibrated to show small frequency increments to the required accuracy. Measurements of the signal-frequency increments are made by observing the change in the i.f. of the receiver under test.

621.317.1.011.5 + 621.396.11.029.64 + 535.343.4] : 546.171.1 **2622**

Ammonia Spectrum in the 1 cm Wavelength Region.—B. Bleaney & R. P. Penrose. (*Nature, Lond.*, 16th March 1946, Vol. 157, No. 3985, pp. 339–340.) Measurements were made over the pressure range 0.2–600 mm Hg by observing, at the higher pressures, the decrease of power transmitted in a waveguide filled with the gas, and at the lower pressures, the damping of a cavity resonator. The results are briefly described and discussed. The absorption spectrum at 1.2 mm Hg is shown graphically for the wavelength range 1.15—1.48 cm. See also 1934 Abstracts p. 260 (Cleeton & Williams).

621.317.1.011.5 : 621.392 **2623**

The Theory of the Second Method of Drude.—B. K. Maibaum. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, Nos. 10/11 & 12, pp. 448–458 & 501–513.) One of the more serious difficulties arising in the use of this method of measuring the dielectric constants and specific conductivities of dielectrics with the aid of a Lecher system is the possibility of negative displacements (see 471 of 1941—Maibaum), *i.e.* of conditions under which an increase, instead of a decrease, in the spacing between the two bridges becomes necessary. Six different existing theories of the method are examined critically, and it is shown that none of them is applicable to the above conditions. The effects of the following factors on the sign of the displacement are discussed: (1) ϵ' and ϵ'' (real and imaginary parts respectively of the complex dielectric constant); (2) suspension straps of the capacitor; (3) increase in diameter of the line conductors at the points at which the straps are connected; (4) the presence of an inductively coupled indicator. The effects of various constants of the capacitor on the results obtained by the Drude method are also discussed, and formulae for calculating these constants are given together with a description of the necessary experiments. In part 2 equations (1) for calculating ϵ' and ϵ'' are quoted, and a general solution of these is found. Simplified formulae (46) are also derived in which the attenuation of the measuring system and the effect of the suspension straps are taken into account.

621.317.32 : 621.3.015.33 **2624**

The Influence of Irradiation on the Measurement of Impulse Voltages with Sphere-Gaps.—J. M. Meek. (*J. Instn elect. Engrs*, Part II, April 1946, Vol. 93, No. 32, pp. 97–115.) Full paper of which summaries were noted in 365 of February and 967 of April.

621.317.33 : 621.611.21 **2625**

The Measurement of the Activity of Quartz Oscillator Crystals.—A. J. Biggs & G. M. Wells. (*J. Instn elect. Engrs*, Part I, April 1946, Vol. 93, No. 64, pp. 191–192.) Long summary of 969 of April.

621.317.335 **2626**

Measurement of the Ratio of Two Small Capacitances using a Tetrode Electrometer.—J. Lacaze. (*C. R. Acad. Sci., Paris*, 18th June 1945, Vol. 220, No. 25, pp. 876–877.)

621.317.35 : 534.61 **2627**

Range Extender for General Radio 760A Sound Analyzer.—Cobine & Curry. (*See* 2456.)

621.317.361 + 621.396.615 : 621.396.611.21 **2628**

Series-Resonant Crystal Oscillators.—Butler. (*See* 2524.)

621.317.715 : 621.394.645.35 **2629**

A Contact Modulated Amplifier to replace Sensitive Suspension Galvanometers.—M. D. Liston, C. E. Quinn, W. E. Sargeant & G. G. Scott. (*Rev. sci. Instrum.*, May 1946, Vol. 17, No. 5, pp. 194–198.) A high gain amplifier with low input impedance for measurement of small d.c. and very low frequency a.c. voltages and currents. The input is chopped by mechanical contacts, amplified, rectified by other synchronous contacts, and recorded by a milliammeter. Contact troubles are avoided in the input circuit by extreme rigidity, and by the use of gold for contacts and a special cadmium-tin mixture for soldering, as both have a low thermal e.m.f. against copper. The input circuit is also carefully shielded with mu-metal, and the size of all loops minimized. The equipment will operate from mains or batteries, and has a noise level of the order of 10^{-9} V, the actual value depending on the input circuit. On test, a zero drift of 4.10^{-9} V was recorded over a period of 4 hours.

621.317.715.5 **2630**

The Use of a Moving Coil Galvanometer for Recording at Frequencies Higher than its Own.—D. C. Johnson. (*J. sci. Instrum.*, June 1946, Vol. 23, No. 6, pp. 113–114.) The speed of response of the galvanometer can be increased at the expense of sensitivity by introducing "electromagnetic stiffness" by means of external resistive and reactive circuits.

621.317.72.029.62 **2631**

A Field-Intensity Meter for V.H.F. — D. C. Summerford. (*QST*, June 1946, Vol. 30, No. 6, pp. 40–42.) Constructional details of a small instrument incorporating an acorn triode rectifier for rough measurements at frequencies up to 225 Mc/s.

621.317.725 **2632**

A Correction Formula for Voltmeter Loading.—R. E. Lafferty. (*Proc. Inst. Radio Engrs, W. & E.*, June 1946, Vol. 34, No. 6, p. 358.) The finite resistance of a current-operated voltmeter causes errors due to the load it imposes on the source being measured. A simple formula is derived which enables the true voltage to be obtained from measurements on two voltage ranges which have a known internal resistance ratio. A similar equation may be used to correct the reading of an ammeter having appreciable resistance.

621.317.725 **2633**

Suppressed-Range Recording Peak Voltmeter.—F. G. Brockman. (*Rev. sci. Instrum.*, May 1946, Vol. 17, No. 5, pp. 177–179.) Description of an instrument designed to detect small fluctuations (0.000 95 V) in relatively large audio-frequency voltages (5–30 V). A single-valve circuit is used, but stabilized filament and h.t. supplies are required. Calibration methods are given in detail.

621.317.733 : 621.395.645 **2634**

A Convenient Amplifier and Null Detector.—H. H. Scott & W. F. Byers. (*Gen. Radio Exp.*, March 1946, Vol. 20, No. 10, pp. 1–3.) The high-gain amplifier is suitable for the range 20 c/s to 100 kc/s. A semi-logarithmic valve voltmeter is included to provide null deflexion indications. Miniature valves are used throughout. The circuit diagram and gain/frequency curves are given.

621.317.733.085.3 **2635**

Phase Sensitive [a.c.-] **Bridge Detector.**—P. H. Hunter. (*Electronic Industr.*, June 1946, Vol. 5, No. 6, pp. 60–61.) The detector consists of a twin-triode network essentially similar to a full-wave grid-controlled rectifier system. It needs no d.c. power supply, and indicates the direction as well as the magnitude of the bridge unbalance. The inclusion of an amplifier increases the sensitivity. The device may be useful in industrial process recording and automatic control as well as in ordinary bridge work.

621.317.738 **2636**

Production Bridge for Incremental [inductance] **Tests.**—W. Muller. (*Electronic Industr.*, May 1946, Vol. 5, No. 5, pp. 72..122.) The apparatus contains d.c. and a.c. power sources with an oscillograph as detector. A switch permits operation as either a Hay or an Owen bridge. Inductances from 1 mH to 50 H may be measured with d.c. up to 1 A, 50–500 H with 0.15 A and above 500 H with 15 mA.

621.317.78 : 621.317.382 **2637**

Oscillographic Arrangement for Measuring Small Powers.—J. Benoit. (*C. R. Acad. Sci., Paris*, 2nd Jan. 1946, Vol. 222, No. 1, pp. 59–60.) The voltage across the load is applied to the X-plates, and the voltage across a very small resistance in series with the load is applied, through a valve with a capacitive load, to the Y-plates, so that the area enclosed by the c.r. trace is proportional to the power in the load.

621.317.78.029.5/.6] : 621.326 **2638**

Load Lamp for Microwave Power Measurements.—J. E. Beggs. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 204..210.) To reduce lead inductance and glass losses in small load lamps, a concentric-line construction has been used with multiple filaments of fine wire strung from inner to outer line. Low-loss sealing glass and a gettered vacuum prevent breakdown when measuring pulsed h.f. power.

621.317.79 : 621.314.24 : 621.396.823 **2639**

Maintenance Testing of Dynamotors.—H. M. Tremaine. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 158..168.) Description and circuit diagram of an equipment for the rapid testing of load characteristics and radio noise interference.

621.317.79 : 621.318.4 **2640**

Coil Short Tests.—N. L. Chalfin. (*Electronic Industr.*, May 1946, Vol. 5, No. 5, p. 77.) A solenoidal iron-cored transformer, with two secondaries connected in opposition, is unbalanced when a coil with a shorted turn is placed on the core near one of the secondaries. The resulting voltage operates a relay or indicator.

621.317.79 : 621.395.82 : 621.395.645 **2641**

Measuring Audio Intermodulation.—N. C. Pickering. (*Electronic Industr.*, June 1946, Vol. 5, No. 6, pp. 56..125.) Sine waves at 100 c/s and 7 kc/s are fed to an amplifier under test. The 100 c/s component is filtered from the amplifier output, leaving the 7 kc/s as a carrier with intermodulation sidebands 7 kc/s ± 100 c/s. This combined signal is amplified and applied to a linear detector which feeds a carrier-level meter and a modulation meter calibrated to read percentage distortion. The theory of the method is summarized, and results of typical measurements are shown graphically.

621.317.79 : 621.396.62 **2642**

Multipurpose Tester.—B. White. (*Radio Craft*, May 1946, Vol. 17, No. 8, pp. 534..567.) Description of an r.f. and a.f. signal tracer that incorporates a volt-, ohm-, and milliampere-meter.

621.317.79 : 621.396.645 **2643**

Visual Radio Alignment.—E. J. Thompson. (*Radio Craft*, May 1946, Vol. 17, No. 8, pp. 540..574.) Description and circuit diagram of a frequency-modulated signal generator ("wobbulator"), mean frequency 415–450 kc/s, bandwidth adjustable 0–40 kc/s.

621.317.79 : 621.396.712 **2644**

Portable Precision Amplifier-Detector.—F. A. Peachey, S. D. Berry & C. Gunn-Russell. (*Wireless Engr*, July 1946, Vol. 23, No. 274, pp. 183–192.)

Description of an instrument for tone-level measurements at 50–10 000 c/s to the nearest 0.1 db over the range + 20 db to − 50 db with respect to 1 mW in 600 Ω. Facilities are provided for measuring peak programme level and noise level down to − 110 db. The two main attenuator controls are geared together so that the algebraic sum of the attenuators is seen directly on the calibrated dial through a window.

621.317.79 : 621.396.9 **2645**

Techniques and Facilities for Microwave Radar Testing.—E. I. Green, H. J. Fisher & F. J. Ferguson. (*Trans. Amer. Inst. elect. Engrs*, May 1946, Vol. 65, No. 5, pp. 274–290.) Equipments and procedures developed at the Bell Telephone Laboratories for testing radar apparatus in the range 500–25 000 Mc/s. The requirements are outlined, and the following items are described: signal generators, their design and application to receiver testing; frequency measurement by the use of tuned cavities; power measurement by the use of thermistors, and, for high power, by the use of directional couplers of known loss in conjunction with thermistors; echo boxes, their design, properties, and uses for testing overall performance; spectrum analysis with echo boxes; standing-wave measurements with various devices; directional couplers; attenuators and pads; oscilloscopes; range calibration: computer test sets.

621.317.79 : 621.397.62 **2646**

A Television Signal Generator: Part 2 — Monoscope and Video Circuits.—R. G. Hibberd. (*Electronic Engng*, July 1946, Vol. 18, No. 221, pp. 204–207.) A detailed description, with circuit diagrams. The frame and line scanning generators each consist of a thyratron feeding a cathode follower with a suitable output stage matched to the low-impedance scanning-coil system, synchronizing impulses being fed to the grid of each thyratron. The monoscope output passes to a video amplifier with a cathode-follower input and output, and then to the impulse-mixing unit where the blanking and synchronizing impulses are mixed into the video signal. All units are supplied from a stabilized power pack. For part 1 see 2255 of August.

621.317.79 : 621.397.645 **2647**

Transient Video Analyzer.—C. Moritz. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 130–135.) A description, with circuit details, of a test set combining a five-signal transient generator and wide-band oscilloscope for checking the performance of wide-band amplifiers connected between them. The five signals are (*a*) a 30-c/s square-wave, (*b*) a 5-kc/s saw tooth, (*c*) a 10-μs pulse repeated at 5 000 per sec, (*d*) a step function, (*e*) a spike function. The sweep of the oscilloscope is synchronized with the signal. The oscilloscope amplifier is designed to have higher fidelity than any ordinary equipment likely to be tested.

621.317.79.029.5 **2648**

LCR Meter for Amateur Use.—W. B. Bernard. (*Radio News*, June 1946, Vol. 35, No. 6, pp. 40..125.) Constructional details of an instrument which measures Q from 10 to 600, capacitance up to 350 $\mu\mu$F accurately and up to 1 μF less accurately, and which can be used as a modulated or unmodulated local oscillator with an output of 1W in the frequency range 90 kc/s–36 Mc/s.

621.318.4.013.22 **2649**

On a System of Coils producing a Uniform Magnetic Field for a Narrow Wilson Chamber.—Nageotte. (*See* 2720.)

621.396 : 621.317 **2650**

Application of Radio Technique to General Measurements.—G. R. Polgreen. (*J. Instn elect. Engrs*, Part I, April 1946, Vol. 93, No. 64, p. 160.) Abstract only.

621.396.615.029.5/.63 **2651**

Test Oscillator TS-47/APR.—D. W. Moore, Jr. (*Radio News*, May 1946, Vol. 35, No. 5, pp. 32–34, 68.) Detailed description of a robust (army) test oscillator covering 40–500 Mc/s in two bands, with 1% frequency accuracy. Provision is made for 1 000-c/s sine-wave modulation or pulse modulation.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

621.3.078 **2652**

On Increasing the Stability of Self-Regulation by Means of Back Coupling.—Peshkoff. (*See* 2784.)

621.317.39.082.7 **2653**

Rapid Moisture Testing of Granular Material.—J. H. Jupe. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 180..186.) An account of the instrument described in 388 of February (Hartshorn & Wilson).

621.365.92 : 664.84 **2654**

Electronics in Processing Foods.—S. R. Winters. (*Radio News*, June 1946, Vol. 35, No. 6, pp. 31..123.) Report on use of dielectric heating in food preservation. See also 393 of February (Moyer & Stotz).

621.38 : 6(048) **2655**

Electronic Uses in Industry.—W. C. White. (*Electronic Industr.*, June 1946, Vol. 5, No. 6, pp. 66..111.) The fourth of a series of selected references, published annually. About four hundred titles are given, with a subject index. For previous lists see 2844 of 1945.

621.383 : 522.2 **2656**

Photoelectric Sight for Solar Telescope.—W. O. Roberts. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 100–103.) A separate guiding telescope is attached to the main telescope, and a disk which masks most of the solar light is automatically centred within 1 second of arc by means of four photocells and associated amplifiers and relays.

621.383 : 551.576 **2657**

On Atmospheric [cloud-height] **Sounding.**—R. Barthélemy. (*C. R. Acad. Sci., Paris*, 18th Feb. 1946, Vol. 222, No. 8, pp. 450–451.) Brief account of an optical echo-sounding device for cloud-height determination apparently identical in principle with the equipment described in 1943 of July (Moles). Extreme range 7 000 metres.

621.383.078 : 778.6 **2658**

Photoelectric Controls for [photographic] **Color Printing.**—J. Robins & L. E. Varden. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 110–115.) A discussion of the problems involved in the production of high quality photographic colour prints on a large scale. Details of photoelectric circuits used in various processes are given.

621.385.833 : 537.133 **2659**

On a Project for a Proton Microscope.— C. Magnan, P. Chanson & A. Ertaud. (*C. R. Acad. Sci., Paris*, 28th May 1945, Vol. 220, No. 22, pp. 770–772.) By using protons instead of electrons the resolving power due to diffraction will be improved by a factor of 40 for the same aperture and equal energy. A resolving power of 3 Å is expected with a magnification of 20 000. Enlargement of the photograph increases magnification to 600 000.

621.389 : 535–1 **2660**

Night Vision with Electronic Infrared Equipment. —(*Electronics*, June 1946, Vol. 19, No. 6, pp. 192..204.) A description of the application of infra-red image converters and searchlights in German military equipments.

621.389 : 623.555.2 : 535–1 **2661**

Electronic Night Sight.—W. MacD. (*Electronics*, June 1946, Vol. 19, No. 6, p. 95.) See also 2346 of August.

621.392.43 : 621.365.92 **2662**

Coupling Method for Dielectric Heating.—Kleinberger. (*See* 2498.)

621.396.619.16 : 621.385.38 **2663**

Thyratron Pulser Tube for Industrial Microwaves. —(*See* 2770.)

621.398 : 534.43 **2664**

[Gramophone] **Remote Record-Selection System.** —F. M. Berry. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 104–106.) An oscillator transmits r.f. pulses by a carrier-current system to discriminator circuits in the gramophone cabinet. Twelve carrier frequencies and the use of both alternations of the power line permit the selection of 24 records.

621.398 : 621.397 **2665**

Tele-Guided Missiles.—(*See* 2738.)

623.26 : 621.396.9 **2666**

Mine Detectors.—(*Wireless World*, May 1946, Vol. 52, No. 5, pp. 166–168.) An account of the British Army detector No. 4, with circuit diagram. See also 1626 of June (West).

623.454.25 : 621.396.9 **2667**

The Radio Proximity Fuze.—L. G. Hector. (*Proc. Radio Cl. Amer.*, March 1946, Vol. 23, No. 3, pp. 3–6.)

786.6 : 621.383 **2668**

Photo-Electronic Organ : Part 1.—R. E. Campbell & L. E. Greenlee. (*Radio News*, June 1946, Vol. 35, No. 6, pp. 25..110.) A beam of light passes through a tone pattern printed on a rotating wheel to a photocell. The impulses are amplified and reproduced on a loudspeaker. A detailed description of the construction of the instrument.

621.385.833 **2669**

The Electron Microscope. [Book Review] — D. Gabor. Hulton Press, 1945, 104 pp., 4s. 6d. (*Wireless World*, May 1946, Vol. 52, No. 5, p. 168.) Concerned with the electron-optical aspects.

PROPAGATION OF WAVES

523.78 : 551.51.053.5 : 621.396.11 **2670**

The Influence of an Eclipse of the Sun on the Ionosphere.—Smith-Rose. (*See* 2562.)

541.133 : [621.3.029.5/.6 **2671**

The Variation of the Electrical Conductivity of Electrolytes with Frequency.— Maloff. (*See* 2549.)

621.396.11 **2672**

Theory of the Coastal Refraction of Electromagnetic Waves.—G. Grünberg. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, Nos. 3/4, pp. 84–111. English version in *J. Phys., U.S.S.R.*, 1942, Vol. 6, No. 5, pp. 185–209.) The difficulties of investigating the propagation of electromagnetic waves in the presence of three different media (air, sea and land) are pointed out, and a simplified treatment of the problem is presented. The propagation of the waves along a boundary plane between the media (air and ground) is considered, and approximate boundary conditions (16) for the electric field component normal to the surface of the ground are derived using the fact that for sufficiently high conductivity of the medium the fall of the intensity of the field penetrating it does not depend on the character of the field outside the medium. From these conditions, assuming that the sea is an ideal conductor and also that the surface of the earth is a horizontal plane, an integral equation (21) of the component is obtained. This is the main equation of the problem, an exact solution of which would give a complete answer. In the present paper an approximate solution (41) of the equation is found and its implications discussed in detail for the case of plane waves impinging on an unlimited rectilinear coast. General considerations are also given regarding an approximate solution of the equation for the case of small islands of an arbitary shape. Formulae are given for evaluating definite and indefinite integrals containing Bessel functions.

This is the paper referred to in 1830 of 1943 and 3386 of 1944.

621.396.11.029.64 **2673**

An Experimental Investigation of the Reflection and Absorption of Radiation of 9-cm Wavelength.— L. H. Ford & R. Oliver. (*Proc. phys. Soc.*, 1st May 1946, Vol. 58, No. 327, pp. 265–280.) Using angles of incidence ranging from 45° to 80°, measurements were made on the reflecting power of the surfaces of level and uneven bare ground, vegetation-covered ground, tap water, and a 4% salt solution. " Specular reflection was found to occur only from very level surfaces ; the absorptions of these surface media were measured, and from the combined measurements of reflection and absorption their electrical constants were derived.

" Rough surfaces, either of bare ground or vegetation-covered ground, gave values of reflection coefficient in general agreement with the optical rule that regular reflection is only observed from an uneven surface if the product of the depth of the surface irregularities and the cosine of the angle of incidence is a small fraction of the wavelength. If this fraction exceeded $\frac{1}{2}\lambda$, the values of reflection coefficient measured were about 0.1.

" The calculated values of reflection coefficient corresponding to dry soil, wet soil, and sea water, for angles of incidence varying from 0° to 85° are given in an appendix to the paper."

621.396.11 : 551.51.053.5 " 1946.05 " **2674**

Short-Wave Conditions : Expectations for May.— T. W. Bennington. (*Wireless World*, May 1946, Vol. 52, No. 5, p. 165.)

621.396.11 : 551.51.053.5] " 1946.06 " **2675**
Short-Wave Conditions: Expectations for June.—T. W. Bennington. (*Wireless World*, June 1946, Vol. 52, No. 6, p.207.)

RECEPTION

621.396.61 + 621.396.621].029.63 **2676**
Getting Started on 420 Mc/s.—Hoisington. (*See* 2757.)

621.396.61 + 621.396.677].029.63 **2677**
CQ 2 400 Mc/s : Transceivers and Antennas for the 13-Centimeter Band.—Koch & Floyd. (*See* 2758.)

621.396.61.029.63 **2678**
A U.H.F. Ham Transceiver.—I. Queen. (*Radio Craft*, May 1946, Vol. 17, No. 8, pp. 545..588.) Description of a small equipment for 420–450 Mc/s.

621.396.621 + 621.395.645 **2679**
Superamp with Tuner.—Brennan. (*See* 2512.)

621.396.621 **2680**
The Radio News Circuit File.—(*Radio News*, May & June 1946, Vol. 35, Nos. 5 & 6, pp. 60..82 & 62..72.) Circuit diagrams and parts lists of 21 American post-war commercial broadcast receivers, arranged so that they can be cut out and attached to 5 in. × 3 in. filing cards.

621.396.621 **2681**
Looking Over the Postwar Receivers.—B. G. (*QST*, June 1946, Vol. 30, No. 6, pp. 24..108.) Review of the mechanical and electrical features of the Hammarlund HQ-129-X. The noise limiter is explained with the aid of a circuit diagram.

621.396.621 **2682**
High-Level Detector. — J. C. Rankin. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 212..218.) Audio-frequency amplification is eliminated from a radio receiver by using a low-impedance copper-oxide rectifier immediately before the loudspeaker and following an i.f. power amplifier.

621.396.621 **2683**
Radio Data Sheet 335.—(*Radio Craft*, May 1946, Vol. 17, No. 8, p. 547.) Servicing data for RCA Victor receivers 54B1, 54B1-N, 54B2 & 54B3.

621.396.621 : 621.396.662 **2684**
Practical Radio Course : Part 43.—A. A. Ghirardi. (*Radio News*, April 1946, Vol. 35, No. 4, pp. 46..107.) Automatic frequency control of receivers. For previous parts of the series see 1646 of June.

621.396.621 : 621.396.9 + 621.396.61 **2685**
Radar Technique.—F. L. D. (*See* 2751.)

621.396.621.004.67 **2686**
Radio Servicing.—(*Elect. Rev., Lond.*, 11th Jan. 1946, Vol. 138, No. 3555, p. 70.) Summary of I.E.E. discussion led by R. C. G. Williams. The need for more test equipment and for a recognized qualification for servicemen was stressed.

621.396.621.029.56/.58 **2687**
The " Super-3 ".—(*Radio News*, June 1946, Vol. 35, No. 6, pp. 76..88.) Constructional details of a three-valve regenerative receiver for 1.7–14.5 Mc/s.

621.396.621.029.6 : 621.317.1 **2688**
V.H.F. Receiver [selectivity] **Measurements.**—Gordon & George. (*See* 2621.)

621.396.621.029.62.004.67 **2689**
100 Mc/s Receivers require New Servicing Techniques.—D. W. Gunn. (*Radio News*, May 1946, Vol. 35, No. 5, pp. 36..68.) Brief survey of the complications which a service-engineer will encounter in f.m. receivers for frequencies over 50 Mc/s.

621.396.621.5 **2690**
Super-Regenerative Receivers.—" Cathode Ray ". (*Wireless World*, June 1946, Vol. 52, No. 6, pp. 182–186.) A simple explanation of the manner of operation prompted by the recent successful application of the principle in military equipments.

621.396.621.5 **2691**
The Super-Regenerative Detector : an Analytical and Experimental Investigation.—F. R. W. Strafford. (*J. Instn elect. Engrs*, Part I, April 1946, Vol. 93, No. 64, p. 192.) Summary of 1032 of April.

621.396.621.54 **2692**
Practical Radio Course : Parts 44 & 45.—A. A. Ghirardi. (*Radio News*, May & June 1946, Vol. 35, Nos. 5 & 6, pp. 48..123 & 55..70.) An account of frequency conversion in superheterodyne receivers. For previous parts in the series see 2684 above.

621.396.621.54.029.62 **2693**
Miniature Tubes in a Six-Meter Converter.—R. W. Houghton. (*QST*, June 1946, Vol. 30, No. 6, pp. 18–21.) Constructional details of a set for frequency conversion to 10.5 Mc/s.

621.396.622 **2694**
Audio - Modulated Detection : an Improved Method for Reception of C.W. Signals.—D. A. Griffin & L. C. Waller. (*QST*, July 1946, Vol. 30, No. 7, pp. 13–15, 124.) Two diodes are connected in opposite senses, in parallel, with a common load resistance. One diode is biased by a square-wave a.f. signal from a special generator. This provides a.f. modulation of c.w. signals, and also an upper-level limiting action. Bias applied to the other diode provides low-level limiting. The advantage in signal/noise ratio is considerable, especially if an a.f. output filter is used.

621.396.82 **2695**
Analysis of Radio Interference Phenomena.—(*Radio News*, June 1946, Vol. 35, No. 6, p. 54.) A table showing character, cause, type of receivers affected, where prevalent, and suggested service remedies, for 11 types of interference.

621.396.822 **2696**
A Theory of Valve and Circuit Noise.—N. R. Campbell & V. J. Francis. (*J. Instn elect. Engrs*, Part I, April 1946, Vol. 93, No. 64, p. 190.) Summary of 1037 of April.

621.396.822 : 621.315.59 **2697**
Voltage Fluctuations in Electronic Semi-Conductors.—Davidov. (*See* 2603.)

621.396.822 : 621.396.13 **2698**
Theoretical Signal-to-Noise Ratios.—J. E. Smith. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 150–152,

154.) The sources of noise are described. Signal/noise ratios are derived in terms of the frequency bands of the signal and of the transmitted radio carriers for single or double a.m. or f.m., as used in u.h.f. multiplex relay systems. The relative advantages of the systems are shown in tabular form.

621.396.822 : 621.396.671 **2699**

Fluctuation Noise in a Receiving Aerial.—R. E. Burgess. (*Proc. phys. Soc.*, 1st May 1946, Vol. 58, No. 327, pp. 313–321.) "The factors which determine the signal/noise ratio at the terminals of a receiving aerial are discussed. The aerial noise considered is the random fluctuation type, consisting of (i) thermal noise associated with the loss resistance of the aerial, and (ii) noise associated with the radiation resistance which is induced by the surroundings. The effective temperature of the radiation resistance is expressed in terms of the temperature distribution of the surroundings and the distribution of power dissipation when the aerial is transmitting. Radiation from the sun and from the Milky Way are briefly discussed, and it is shown that the detection of solar radiation at radio frequencies requires the use of highly directional aerials. The limitations imposed by the receiver noise on (*a*) the sensitivity of the reception of signals, and (*b*) the accuracy of measurement of aerial noise, are discussed and the results presented graphically.

"The conclusions are of most practical interest at the higher radio frequencies (above about 20 Mc/s) where atmospheric noise is negligible."

621.396.823 **2700**

Interference from Industrial Electronic Apparatus.—(*Wireless World*, June 1946, Vol. 52, No. 6, p. 198.) Report of an I.E.E. discussion led by M. R. Gavin.

STATIONS AND COMMUNICATION SYSTEMS

621.396 **2701**

Engineers study F.M.—(*Electronic Industr.*, May 1946, Vol. 5, No. 5, pp. 66–70.) Extracts from papers read at the sixth Broadcasting Conference, held at Columbus, Ohio, in March 1946, covering other subjects besides f.m. See also 2125 of August and cross references.

621.396.1 **2702**

The Conference on [allocation of] **Radio Frequencies for Civilian Services in the Liberated Countries of Europe.**—L. B. de Cléjoulx. (*Onde élect.*, Jan. 1946, Vol. 26, No. 226, pp. 45–46.) A short account of the conference held in London in Sept. 1945.

621.396.619.018.41 **2703**

Frequency Modulation: Parts 1 & 2.—P. Besson. (*Onde élect.*, Jan.-May 1946, Vol. 26, Nos. 226–230, pp. 6–25, 74–91, 107–129, 155–172 & 204–214, with other parts to follow.) A comprehensive review of existing knowledge. Part 1 is in nine chapters as follows: introduction; history; principles of f.m.; production of f.m. oscillations; spectra of f.m. oscillations; reception; comparison of f.m. and a.m. reception; propagation of f.m. waves; comparative advantages and disadvantages of f.m. and a.m. Part 2, dealing with technique and applications, is in four chapters as follows: transmitters; receivers; measurements; applications. The instalments to which references are given include part 1, and chapters 1, 2 and part of chapter 3 of part 2.

621.396.619.018.41 **2704**

Spectrum of a Phase- or Frequency-Modulated Wave.—R. E. Burgess. (*Wireless Engr*, July 1946, Vol. 23, No. 274, pp. 203–204.) If the carrier frequency is an integral or half-integral multiple of the modulation frequency, each sidewave is a doublet and, in general, the mean square value of the wave is not equal to half the square of the amplitude. See also 2637 of 1944 (Colebrook).

621.396.619.018.41 : 621.396.61 **2705**

Frequency Modulated Transmitters for Police and Similar Services.—Fairbairn. (*See* 2750.)

621.396.619.16 + 621.396.61.029.64 **2706**

Multi-Channel Pulse Modulation.—(*Wireless World*, June 1946, Vol. 52, No. 6, pp. 187–192.) Details of the British Army Signalling Equipment No. 10, operating on a wavelength in the 6–7 cm band, and using pulse modulation.

"Narrow pulses recurrent at 9 kc/s are width-modulated by the a.f. signals which are to be transmitted. The pulses are narrow with an average duration of 3.5 μs. Each of the eight speech channels modulates a separate train of pulses of the same recurrence frequency, but all the trains are staggered in time so that they can fit together without interference. A synchronizing pulse is also included to control the receiving apparatus which sorts out the pulses, demodulates them, and routes the a.f. signals to the proper output circuits." See also 470 of February.

621.396.619.16 **2707**

Pulse Modulation.—F. F. Roberts & J. C. Simmonds. (*Wireless Engr*, July 1946, Vol. 23, No. 274, p. 204.) Continuation of correspondence on 183 of January (Roberts & Simmonds) following 1676 of June (Shepherd).

621.396.7 (058.7) **2708**

Radio Stations.—(*Electronic Industr.*, May 1946, Vol. 5, No. 5, pp. 89–92.) Directory giving the addresses of U.S. broadcasting stations for a.m., f.m. and television, and names of the chief engineers.

621.396.712.004.5 **2709**

Preventive Maintenance for Broadcast Stations.—C. H. Singer. (*Communications*, June 1946, Vol. 26, No. 6, pp. 22–28, 52.) First of a series of papers dealing with the methods and equipment used. The need for proper care of tools is emphasized. Descriptions are given of simple tools used in the maintenance of relay contacts and commutators.

621.396.931 **2710**

Railroad F.M. Satellite System.—W. S. Halstead. (*Communications*, May 1946, Vol. 26, No. 5, pp. 17–21..55.) See also 2325 of August (Halstead).

621.396.931 **2711**

Railroad Radio — from F.C.C. to I.C.C.—J. Courtney. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 92–94.) A general discussion of the advantages of a railway radio service compared with existing manual block systems.

621.396.931.029.62 **2712**

V.H.F. Communication Equipment.—(*Wireless World*, June 1946, Vol. 52, No. 6, pp. 180–181.) A short general description of some of the equipment for the police radio system described in 1357 of May and 2326 of August.

SUBSIDIARY APPARATUS

621.314.2 **2713**

Equivalent Capacitances of Transformer Windings.—Duerdoth. (*See* 2493.)

621.314.632 **2714**

The Effect of Temperature Gradient on the Rectifying Action of Copper Oxide Rectifiers.—Amirkhanoff. (*See* 2602.)

621.316.86 : 546.281.26 **2715**

Silicon Carbide [non-ohmic] **Resistors.**—Ashworth, Needham & Sillars. (*See* 2606.)

621.316.974 : 621.318.4.017.31 **2716**

Power Loss in Electromagnetic Screens.—C. A. Siocos. (*Wireless Engr*, July 1946, Vol. 23, No. 274, p. 202.) A letter in which the method of Davidson *et al.* (1077 of April) is extended to the calculation of the eddy current density produced by a coil in an infinite shielding plane.

621.317.755 **2717**

A Simple Oscilloscope : using the Mains as a Time Base.—F. P. Williams. (*Wireless World*, June 1946, Vol. 52, No. 6, p. 206.) Deflecting and focusing coils are made nearly to follow television practice. The "straight" middle portion of the sine wave from the mains is used to provide a timebase.

621.318.22/.23 **2718**

Modern Hard Magnetic Materials.—Hoselitz. (*See* 2607.)

621.318.24 **2719**

Capacitor Discharge Magnetizer for Plant Shops.—W. L. Porta. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 168..188.) Description of an equipment for magnetizing small permanent magnets. The essential components are a source of d.c. voltage, a capacitor, and a special transformer. The transformer, which must have a low leakage-reactance factor, carries a 1-millisecond power impulse. The capacitor discharge into the primary is initiated through a manually controlled ignitron tube.

621.318.4.013.22 **2720**

On a System of Coils producing a Uniform Magnetic Field for a Narrow Wilson Chamber.—E. Nageotte. (*C. R. Acad. Sci., Paris*, 16th April 1945, Vol. 220, No. 16, pp. 557–559.) The coils are each wound on a rectangular former of which the long sides are curved in a direction normal to the plane of the undistorted rectangle. The coils are arranged so that the convex sides of the formers are together. The magnetic field shows variations of 0.1% over a space in which the Helmholtz arrangement would show variations of 0.5%.

621.318.44 **2721**

The Technique of Toroidal Winding.—F. E. Planer. (*Electronic Engng*, July 1946, Vol. 18, No. 221, pp. 199–203.) A brief description of the advantages of toroidal coils and an account of the principle of a toroidal winding machine. Various methods are given for maintaining constant tension in the wire, illustrated by photographs of representative types of machine.

621.318.57 **2722**

A Simple Electronic Relay.—F. A. P. Maggs. (*J. sci. Instrum.*, April 1946, Vol. 23, No. 4, pp. 85–86.) Simple valve circuits for operating electromagnetic and thermal types of relay.

621.319.42 **2723**

Capacitor Machine.—(*Radio, N.Y.*, April 1946, Vol. 30, No. 4, pp. 10, 12.) Illustrated note on a U.S. Dept. of Commerce OPB report PB421 by F. E. Henderson, describing a German (Bosch Co.) method of making paper capacitors, in which the usual metal foil is replaced by a film of zinc or cadmium deposited on the paper dielectric.

621.383 **2724**

Cooling Photosensitive Cells [by the use of solid CO_2].—E. F. Coleman. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 220 . . 224.)

621.383.2 : 621.314.6 **2725**

Experimental Behaviour of a Photoelectric Cell under the Influence of an Alternating Potential of Very High Frequency.—D. Charles. (*C. R. Acad. Sci., Paris*, 29th Oct. 1945, Vol. 221, No. 18, pp. 495–497.) It has previously been shown (1948 of 1941—Geest) that over particular frequency ranges and for particular voltages the cell gives abnormally high rectified currents, even when not illuminated. Special cells were made to investigate this phenomenon, using a number of different photoelectric materials. Potential differences of 0–300 V were applied at frequencies of 60–120 Mc/s. The following results were obtained: (*a*) Ni and Al cathodes do not show the phenomenon; (*b*) for a given frequency, the rectified current increases to a maximum, then drops abruptly to zero as the h.f. voltage is increased; (*c*) for a given voltage the output rises to a maximum and falls again as the frequency is increased; (*d*) positive bias increases, and negative bias decreases the output; (*e*) the phenomena are unaffected by illumination; (*f*) cooling to −140°C neither stops the phenomenon nor prevents it from starting; (*g*) modulation at 10 Mc/s has no effect; (*h*) a magnetic field normal to the axis stops the phenomenon. See also 2726 below.

621.383.2 : 621.314.6 **2726**

Theory of the Behaviour of a Photoelectric Cell under the Influence of an Alternating Potential of Very High Frequency.—D. Charles. (*C. R. Acad. Sci., Paris*, 2nd Jan. 1946, Vol. 222, No. 1, pp. 65–67.) For experimental work see 2725 above. Electron trajectories were calculated by numerical integration of the equations of motion. For a fixed h.f. voltage and frequency a group of electrons with initial velocities lying within a small range are concerned in a resonant phenomenon. Complete calculation of the response curves as a function of frequency for different values of h.f. voltage for a caesium cell gives results in good agreement with experiment.

621.385.18 : 621.396.9 **2727**

The Gas-Discharge Transmit-Receive Switch.—Samuel, Clark & Mumford. (*See* 2783.)

621.389 : 535-1 **2728**

Night Vision with Electronic Infrared Equipment.—(*See* 2660.)

621.389 : 623.555.2 : 535-1 **2729**

Electronic Night Sight.—W. MacD. (*See* 2661.)

621.394.624 **2730**

Electronic Code Translator.—H. W. Babcock. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 120–122.) Code signals (*e.g.* Morse) from a receiver are fed into a discriminator in which five or more pairs of thyratrons produce a unique voltage determined by each group of dots and dashes. This triggers a gas-filled tube. Illumination from the tube causes corresponding letters and numerals to appear on a moving fluorescent screen.

621.396.66 : 621.395.63 **2731**

Selective Calling System.—J. K. Kulansky. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 96–99.) A description of a system for positive control of remote communication equipment based on the transmission of suitably pulsed audio signals. The coding and decoding devices can be added to existing transmitter and mobile receivers respectively, enabling a control operator to call any of 84 stations by dialling a four-digit number.

621.396.662.2.029.6 **2732**

V.H.F. Coil Design.—A. H. Meyerson. (*Communications*, June 1946, Vol. 26, No. 6, pp. 46–47, 50.) The influences of coil shape and dimensions on the Q and on stability with temperature are examined experimentally for frequencies in the range 60–120 Mc/s. See also 66 of January (Meyerson).

621.396.682 **2733**

Type 1261-A Power Supply.—E. E. Gross. (*Gen. Radio Exp.*, March 1946, Vol. 20, No. 10, pp. 4–6.) Description and circuit diagram of an a.c.-operated power supply for instruments which use the U.S. Signal Corps BA48 Battery Block (Burgess Type 6TA60).

621.396.689 : 621.362 **2734**

Thermoelectric Generator for Portable Equipment.—J. M. Lee. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 196..202.) Banks of chromel-P/constantan thermocouples embedded in ceramic material and heated by a gasoline burner give power outputs up to 20 W at 12 V. The couples have a useful life of about 2 000 hours, and the generator weighs about 2½ lb per watt output.

771.448.1 : 778.39 **2735**

A High-Power Stroboscope.—D. A. Senior. (*J. sci. Instrum.*, April 1946, Vol. 23, No. 4, pp. 81–83.) Description of the circuit for producing, with a suitable discharge tube, 1 000 5-μs flashes a second for periods of several seconds, each with sufficient intensity to permit photography by reflected light of areas up to 50 sq. ft.

TELEVISION AND PHOTOTELEGRAPHY

621.397 **2736**

Practical Television.—R. A. Monfort. (*Radio News*, May 1946, Vol. 35, No. 5, pp. 38..120.) A semi-technical explanation of the principles and of the main parts of the equipment.

621.397 **2737**

4-Color Facsimile Transmission.—E. C. Thomson. (*Communications*, May 1946, Vol. 26, No. 5, pp. 32–34.) Four black and white pictures for use in a colour-superposition process are transmitted separately. Report of a partly successful experimental transmission by Cable & Wireless Ltd between England and Australia.

621.397 : 621.398 **2738**

Tele-Guided Missiles.—(*Electronic Industr.*, May 1946, Vol. 5, No. 5, pp. 62–65 . . 118.) A 325-line, 40-frames/sec television transmitter in a remotely controlled bomb sends a picture of the target to the bomb aimer. A "Vericon" tube is used in the transmitter, with stabilized supplies, and the iris of the lens system is controlled by the video signal to give a constant average signal intensity. Circuit diagrams are given.

621.397 : 621.398 **2739**

Television Equipment for Guided Missiles.—C. J. Marshall & L. Katz. (*Proc. Inst. Radio Engrs, W. & E.*, June 1946, Vol. 34, No. 6, pp. 375–401.) "A brief history of the technical problems associated with the development of compact airborne television equipment is outlined. The system provides resolution, linearity, and stability which approaches that obtained from broadcast equipment. Technical difficulties which arose after the completion of the equipment design are described. The final solution of these and other problems resulting from its installation in guided missiles are discussed. Photographs taken from the receiver screen during experimental flights are shown."

621.397.5 **2740**

Contribution to the Study of a Video Standard.—Y. Angel. (*Onde élect.*, Feb. 1946, Vol. 26, No. 227, pp. 60–73.) The definition of a television image is no longer limited by technique, but by economic and practical considerations. As a preliminary to the large-scale development of television it is necessary to agree on standards for the transmitted signal. For this purpose it is necessary to determine the optimum definition. The article gives a detailed analysis of the technical and subjective factors involved, and concludes that the standard should be (*a*) 1 200–1 300 lines with fourfold interlacing with the sequence 1-3-4-2 (or 1-3-2-4), or (*b*) 800–900 lines with twofold interlacing.

621.397.5 **2741**

1 015-Line Television Apparatus of the Compagnie des Compteurs, Montrouge.—P. Mandel. (*Onde élect.*, Jan. 1946, Vol. 26, No. 226, pp. 26–37.) A description of development work by the company; a theoretical and practical examination of the requirements for a television system with detail limited only by visual acuity. The work eventually realized a complete system, including the radio link, on 145 Mc/s. The development included apparatus permitting a wide range of scanning, both in lines and degree of interlacing. The final selection of interlaced scanning with 1 015 lines was based on tests over a wide range of values.

621.397.62 : 621.317.79 **2742**

A Television Signal Generator : Part 2—Monoscope and Video Circuits.—Hibberd. (*See* 2646.)

621.397.621 **2743**

Television Deflection Channels : Part 13.—E. M. Noll. (*Radio News*, May 1946, Vol. 35, No. 5, pp. 55 . . 147.) Description of circuits for generating and synchronizing the sweep signals, with particular reference to the G.E. Model 90 receiver. For other parts in this series on television circuits see 2349 of August (which should read part 14) and back references.

621.397.645.2 : 621.396.621.54 **2744**

I.F. Amplifiers in Television Receivers.—Kronenberg. (*See* 2534.)

621.397 + 621.396 **2745**

Modern Practical Radio and Television. [Book Review]—Quarrington. (*See* 2789.)

621.397 **2746**

Television, the Eyes of Tomorrow. [Book Review]—W. C. Eddy. Prentice-Hall, New York, 1945, 330 pp., $3.75. (*Electronics*, May 1946, Vol. 19, No. 5, p. 320.)

TRANSMISSION

621.396.61 **2747**

F.C.C. Approved A.M. Broadcast Transmitters.—R. G. Peters. (*Communications*, May 1946, Vol. 26, No. 5, pp. 26..34.) Some features, including circuit diagrams, of Collins, Gates and R.C.A. a.m. transmitters in the range 100 W–50 kW.

621.396.61 **2748**

Modern A.M. Transmitter Design. — W. E. Phillips & C. Probeck. (*Radio, N.Y.*, April 1946, Vol. 30, No. 4, pp. 30..54.) Some modern improvements, and a description (with circuit diagram) of a 250-W transmitter of quality comparable with that of the largest stations.

621.396.61 **2749**

High Power in Two Stages. — D. Mix. (*QST*, June 1946, Vol. 30, No. 6, pp. 13–17.) A crystal oscillator operating in the 3.5-, 7-, 14- and 28-Mc/s bands feeds an 800-W beam-tetrode transmitter. Shunt feed enables plug-in coils to be used with safety.

621.396.61 : 621.396.619.018.41 **2750**

Frequency Modulated Transmitters for Police and Similar Services.—E. P. Fairbairn. (*Electronic Engng*, July 1946, Vol. 18, No. 221, pp. 213–218.) The main advantage of f.m. is freedom from interference in dense traffic areas. Tests show that a small deviation at the transmitter gives widest service area at some expense in signal/noise ratio. A circuit diagram is given of a 10-W phase-modulated transmitter. Other illustrations show typical headquarters and mobile equipments. Crystal-controlled receivers are used. See also 2326 of August (Brinkley).

621.396.61+621.396.621] : 621.396.9 **2751**

Radar Technique.—F.L.D. (*Wireless World*, May 1946, Vol. 52, No. 5, pp. 154–156.) Review of papers on receivers and transmitters presented at the I.E.E. Radiolocation Convention.

621.396.61 : 621.396.933 **2752**

Unit-Type Multi-Channel Aircraft Ground Transmitter.—R. G. Peters. (*Communications*, June 1946, Vol. 26, No. 6, pp. 54–55.) Description of an equipment covering the ranges 200–540 kc/s, 2–20 Mc/s and 108–140 Mc/s, with circuit diagram of the 108–140 Mc/s, 200-W r.f. circuit.

621.396.61.029.5/.62 **2753**

1 000 Watt R.F. Amplifier for the Ham.—H. D. Hooton. (*Radio News*, May 1946, Vol. 35, No. 5, pp. 28..88.) Constructional details and performance. Uses two 4–125A tubes, and can be operated at frequencies up to 250 Mc/s.

621.396.61.029.56/.58 **2754**

A Beginner's Two-Stage Transmitter.—A. D. Middelton. (*QST*, July 1946, Vol. 30, No. 7, pp. 16–22, 126.) Constructional details of a mains- or battery-operated crystal-controlled c.w. circuit of very simple design for 3.5 and 7 Mc/s.

621.396.61.029.62 **2755**

A Mobile Rig for 50 and 28 Mc/s.—E. P. Tilton. (*QST*, June 1946, Vol. 30, No. 6, pp. 31–35, 110.) For economical operation from a car battery. A crystal-controlled " push-to-talk " transmitter uses midget valves with quick-heating filaments. A rotary converter is used for h.t.

621.396.61.029.62 **2756**

More Stations per Megacycle at Two Meters.—C. F. Hadlock & R. S. Hawkins. (*QST*, July 1946, Vol. 30, No. 7, pp. 61–66.) Constructional details of a 100-W push-pull crystal-controlled transmitter. A 5.4-Mc/s crystal is used with three frequency tripler stages and a power amplifier.

621.396.61 + 621.396.621].029.63 **2757**

Getting Started on 420 Mc/s.—W. F. Hoisington. (*QST*, June 1946, Vol. 30, No. 6, pp. 43–45.) Constructional details of a portable station comprising a half-wave-line transmitter feeding a 6-element array, a modulator, two power units, and a superregenerative receiver.

621.396.61+621.396.677] .029.63 **2758**

CQ 2 400 Mc/s : Transceivers and Antennas for the 13-Centimeter Band.—A. R. Koch & G. H. Floyd. (*QST*, July 1946, Vol. 30, No. 7, pp. 32–38.) A cavity-tuned 2C40 (lighthouse) tube is used as oscillator and superregenerative detector with a separate quench oscillator working at 100–250 kc/s. Constructional details are given for the tuned-plate tuned-grid cavity. Two aerials with parabolic reflectors are described ; the smaller has a gain of about 25, the larger has a 7° beam and a power gain of about 200.

621.396.61.029.63 **2759**

A U.H.F. Ham Transceiver.—Queen. (*See* 2678.)

621.396.615 : 621.396.611.21 + 621.317.361 **2760**

Series-Resonant Crystal Oscillators.—Butler. (*See* 2524.)

621.396.615.17 **2761**

Power Pulse Generator.—M. Levy. (*Wireless Engr*, July 1946, Vol. 23, No. 274, pp. 192–196.) Pulses of the required amplitude are produced in a high impedance by a low-power pulse generator, then a succession of cathode followers increases the power and reduces the impedance, without materially reducing the amplitude. In the circuit given, 1 000-V pulses in 150 Ω with a peak pulse output power of 6.5 kW were obtained with an overall efficiency of about 20%.

621.396.619 **2762**

Features of Grid and Plate Modulation in New System.—(*Electronics*, May 1946, Vol. 19, No. 5, pp. 192..196.) Greater power output for size in portable transmitters is obtained by the use of grid modulation on negative half cycles and an additional r.f. amplifier as side-band generator on positive half cycles. A circuit diagram is given.

621.396.619 **2763**

Class " C " Grid Bias Modulation : Part 2.—W. W. Smith. (*Radio News*, May 1946, Vol. 35, No. 5, pp. 70..129.) Study of an inexpensive 100–125-W grid-modulated transmitter, based on 2379 of August.

621.396.619.018.41 **2764**

Frequency-Shift Keying.—G. G. (*QST*, June 1946, Vol. 30, No. 6, pp. 46–48.) While the system speeds up commercial traffic, the bandwidth required appears to be too large for its use in amateur communication.

621.396.619.018.41 **2765**

F.M. Carrier Stabilization : Part 1. — The General Electric and Federal Systems.—I. Queen. (*Radio Craft*, May 1946, Vol. 17, No. 8, pp. 537..549.) An illustrated simple account of the phasitron (see 1405 of May), and of the Miller-effect method.

621.396.619.018.41 **2766**

F.M. Transmitters using Phase Modulators.—N. Marchand. (*Communications*, June 1946, Vol. 26, No. 6, pp. 38–42.) Phase-modulator circuits used in commercial transmitters are analysed in relation to the principles described in 2767 below. Part 6 of a series.

621.396.619.018.41 **2767**

Phase to Frequency Modulation.—N. Marchand. (*Communications*, May 1946, Vol. 26, No. 5, pp. 36..58.) An analysis of the Armstrong method, and an account of the phasitron (see 1405 of May). Part 5 of a series. For other parts in this series see 2766 above, 2383 of August and back references.

621.396.619.018.41 **2768**

A New Angular-Velocity-Modulation System employing Pulse Techniques.—J. F. Gordon. (*Proc. Inst. Radio Engrs, W. & E.*, June 1946, Vol. 34, No. 6, pp. 328–334.) A two-valve multivibrator is controlled by synchronizing pulses from a crystal oscillator applied to the grid of one valve, and the relative duration of the conducting periods of the two valves is controlled by the amplitude of an audio-frequency modulating voltage applied to the grid of the second valve. The multivibrator output is differentiated and the positive pulses clipped, leaving a series of negative pulses which operate a class-C amplifier. An r.f. voltage is therefore produced, of which the phase is controlled by the phase of the pulses, and thus by the amplitude of the modulating voltage. In an experimental transmitter, a multivibrator frequency of 200 kc/s was multiplied to 105.6 Mc/s. Phase deviation was constant within ± 4% for modulation frequencies between 50 and 20 000 c/s and harmonic distortion was small.

621.396.619.018.41 : 621.396.611.21 **2769**

Crystal - Controlled Frequency Modulation. — A. Treskinsky. (*Wireless World*, May 1946, Vol. 52, No. 5, p. 170.) A letter commenting on 479 of February (Lewer).

621.396.619.16 : 621.385.38 **2770**

Thyratron Pulser Tube for Industrial Microwaves.—(*Electronics*, May 1946, Vol. 19, No. 5, pp. 170..180.) Application of a hydrogen thyratron in a line modulator circuit to new methods of plastic manufacture, high-speed welding, and electroplating. The system with a 4C35 tube can provide 100-kW pulses at a rate of 1 500 per sec, with average power 1 kW.

621.396.645.3.029.56/.58 **2771**

A Conservative Kilowatt.—D. Mix. (*QST*, July 1946, Vol. 30, No. 7, pp. 54–56.) Description of a push-pull amplifier for four amateur bands.

621.396.645.3.029.58 **2772**

Long Leads aren't Necessary.—G. W. Shuart. (*QST*, June 1946, Vol. 30, No. 6, pp. 55–57.) Parasitic oscillations are avoided in a push-pull tetrode amplifier for 28 Mc/s by careful arrangement of components and by neutralizing.

621.396[.65 + .71 + .812.3 **2773**

Radio Communication Developments.—A. H. Mumford. (*Nature, Lond.*, 19th Jan. 1946, Vol. 157, No. 3977, p. 83.) Summary of the inaugural address of the Chairman of the Radio Section, I.E.E. For full paper see 1102 of April.

VALVES AND THERMIONICS

621.385 **2774**

Radio Design Worksheet : No. 49. — Perveance.—(*Radio, N.Y.*, June 1946, Vol. 30, No. 6, p. 29.)

621.385 **2775**

The Electron-Optical Theory of Ultra-High-Frequency Oscillators.—P. Golubkoff. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, Nos. 7/8, pp. 289–306.) There are three types of u.h.f. oscillators : retarding-field type, magnetrons, and electron-beam type. Various theories of these oscillators have been developed, but they are usually based on a study of the movement of a single (isolated) electron, and each applies to one type of oscillator only. The author proposes a new theory based on the following considerations. (1) The electronic processes and the mechanisms for sustaining oscillations in all types are identical. The primary mechanism is a continuous electron stream in which a process of phase focusing takes place, and this establishes the necessary interaction between the stream and the elements of the oscillatory system. Thus all types of oscillators can be regarded as electron-beam devices and interpreted by a single theory. (2) From the point of view of kinematics the physics of ultra-high frequencies can be regarded as a development as well as a practical application of electron optics.

From these considerations the author has developed a general method of investigation in which the conception of a moving focus in an electron stream is introduced, and the movement of the focus studied. It is possible, with the aid of this method, to interpret the main characteristics of u.h.f. oscillators of all types. A brief survey of an extensive theoretical and experimental investigation by the author is presented to support this claim. The following are the main points of the survey. The movement of an electron stream in the absence of a retarding field is examined, and the conclusions reached are applied to the case of klystrons. An analogy between klystrons and Barkhausen oscillators is established. The focusing of the stream in constant and in alternating retarding fields is discussed, and the main features of the Barkhausen circuit, such as the discreteness of the regions of oscillations, the position of the centres of these regions, the appearance of "dwarf" waves, etc., are explained. For a general case of the triode when the electron stream is acted upon by two electrodes at the boundaries of the focusing space (and not by one—the phase lens—as in the previous cases), a law is formulated governing the distribution of the centres of the regions of oscillations in the plane V_A, V_G. The focusing of the electron stream in a magnetic field is also considered, and a theoretical interpretation of the operation of the magnetron with a whole anode is given.

621.385 **2776**

Contribution to the Study of Reflex Velocity-Modulation Oscillators.—M. Kuhner & A. M. Gratzmuller. (*Onde élect.*, Jan. 1946, Vol. 26, No. 226, pp. 38–44.) A simple account of the theory of the reflection klystron, and a description of a number of types developed at the L.M.T. laboratories in 1943–1944. These embody glass-metal disk seals and external tunable cavities, tuning either by the screwing in of pistons, or by single or double rectangular plungers moving in rectangular cavities. One model of the latter type gave a maximum output of 200 mW at 149 mm wavelength, with an efficiency of 1%, and had a tuning range of 95 to 156 mm.

621.385 **2777**

Electron Ballistics in High-Frequency Fields.—A. L. Samuel. (*Bell Syst. tech. J.*, Jan. 1946, Vol. 25, No. 1, Supplementary page.) Corrections to 1396 of May.

621.385 : 621.396.9 **2778**

Radar Technique.—M. G. S. : H. B. D. (*Wireless World*, May 1946, Vol. 52, No. 5, pp. 146–151.) Review of papers on valves presented at the I.E.E. Radiolocation Convention.

621.385.1.032.216 : 537.583 **2779**

On a New Method of Measuring the Intensity of the Saturation Current in an Oxide Cathode.—R. Champeix. (*C. R. Acad. Sci., Paris*, 23rd May 1945, Vol. 220, No. 21, pp. 736–738.) A capacitor is discharged through the valve under test, once per second. The resulting impulsive current is passed through a non-inductive resistor of small value, and the potential drop so produced is used to trigger a thyratron which carries an adjustable grid bias. The bias is set to the maximum negative value at which the impulses will fire the discharge, and its value is used as a measure of the current in the valve under test.

Curves of electron current against applied voltage have the same general shape as those for pure tungsten, though higher voltages are necessary to produce saturation. The phenomenon of increasing saturation current with increase of applied voltage gradient at the cathode (Schottky's law) is much more marked for oxide cathodes than for pure metals.

621.385.16 **2780**

Recent Developments in Magnetron Technique.—G. Goudet. (*Onde élect.*, Feb. 1946, Vol. 26, No. 227, pp. 49–59.) A short account of the basic theory of the simple magnetron and of the multiple-cavity tube. The frequency and phase relationships of the latter are derived in terms of a closed ring of filter cells, and the field conditions by application of Maxwell's equations to an approximately equivalent system of plane parallel electrodes with equi-spaced gaps in one of them. The mechanism of oscillation is explained in terms of the interaction between the emitted electrons and the high-frequency fields in the annular interelectrode space.

621.385.16.029.64 **2781**

The Cavity Magnetron.—J. T. Randall. (*Proc. phys. Soc.*, 1st May 1946, Vol. 58, No. 327, pp. 247–252.) An address delivered to the Physical Society giving an historical outline of the development.

621.385.16.029.64 **2782**

An Introduction to Multi-Resonator Magnetrons.—R. Latham, A. H. King & L. Rushforth. (*Engineer, Lond.*, 5th & 12th April 1946, Vol. 181, Nos. 4708 & 4709, pp. 310–312 & 331–333.)

621.385.18 : 621.396.9 **2783**

The Gas-Discharge Transmit-Receive Switch.—A. L. Samuel, J. W. Clark & W. W. Mumford. (*Bell Syst. tech. J.*, Jan. 1946, Vol. 25, No. 1, pp. 48–101.) A detailed account of the purpose, design, construction, testing, method of application, and performance, of gas-filled resonant-cavity tubes used to protect radar receivers from damage due to the high-power transmitted pulse, and to prevent energy received in the dual-purpose aerial from being absorbed by the quiescent transmitter instead of by the receiver. The tubes operate by presenting a virtual short-circuit when discharged by the transmitted pulse, and an open-circuit when undischarged. A mathematical analysis of an idealized system is developed, and an account is included of the parameters of the coupling holes in the associated waveguides.

MISCELLANEOUS

621.3.078 **2784**

On Increasing the Stability of Self-Regulation by Means of Back Coupling.—V. Peshkoff. *Zh. eksp. teor. Fiz.*, 1944, Vol. 14, No. 12, pp. 514–518.) Very often self-oscillations appear in automatic regulating systems. In many cases this can be prevented by introducing back coupling between the regulating indicator and the regulated mechanism. A detailed mathematical analysis is given as an example, confirmed by experiments, of Bancroft's thyratron thermostat (2253 of 1942) in which a transformer provides the required back coupling.

621.38/.39] (058.7) **2785**

1946 Electronic Engineering Directory.—(*See* 2610.)

621.396 **2786**

Engineers study F.M.—(*See* 2701.)

621.396.621.004.67 **2787**

Radio Servicing.—(*See* 2686.)

621.396.7 (058.7) **2788**

Radio Stations.—(*See* 2708.)

621.396 + 621.397 **2789**

Modern Practical Radio and Television. [Book Review]—C. A. Quarrington. W. H. Date (Ed.). The Caxton Pub. Co., London, 3 vols., 70s. (*Electronic Engng*, July 1946, Vol. 18, No. 221, p. 227.)

621.396 **2790**

Principles of Radio for Operators. [Book Review]—R. Atherton. Macmillan, New York, 1945, 344 pp., $3.75. (*Science*, 22nd March 1946, Vol. 103, No. 2673, p. 374.) " . . . outgrowth of the author's experience in training Navy men and women . . . The general plane of instruction is excellent."

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534.131 **2791**

Reflection and Refraction of Non-Stationary Elastic Waves.—Gogoladze. (*See* 2862 & 2864.)

534.131 **2792**

On Rayleigh Boundary Waves.—Gogoladze. (*See* 2863.)

534.231 **2793**

The Sound Field of Moving Sound Sources.—M. F. Shirokov. (*C. R. Acad. Sci. U.R.S.S.*, 10th Dec. 1945, Vol. 49, No. 7, pp. 494–496. In English.) An attempt to find "a new solution of the differential equations of acoustics with sources moving in the medium."

534.321.9 **2794**

On Method in Supersonic Absorption Measurements.—E. J. Pumper. (*C. R. Acad. Sci. U.R.S.S.*, 20th Dec. 1945, Vol. 49, No. 8, pp. 558–560. In English.) A new method of measurement is described in which an acoustic tone-modulated transmitter of supersonic radiation (quartz crystal) is used with a microphone membrane as receiver. The microphone output contains a modulation-frequency component, of amplitude proportional to the square of the intensity of the incident supersonic wave, which gives a measure of the absorption in the liquid or gas interposed between transmitter and receiver.

534.43 : 621.395.61 **2795**

Improved Modulated - Oscillator [gramophone] **Pickup.**—H. Kalmus. (*Electronics*, July 1946, Vol. 19, No. 7, pp. 182..186.) Improved version of the pickup circuit described in 1154 of May (Kalmus). Audio output is increased by 15–20 db, noise is reduced in the same ratio, and microphonics are reduced by 6 db.

534.43 : 621.395.61 : 621.396.619.018.41 **2796**

Simplified Frequency Modulation [applied to gramophone pickup].—Bruck. (*See* 2853.)

534.7 : 621.395.645 **2797**

Auditory Perception.—J. D. Goodell & B. M. H. Michel. (*Electronics*, July 1946, Vol. 19, No. 7, pp. 142–148.) An inverse volume-expansion circuit for automatic tone control is described. It compensates for changes in the response of the ear at different intensity levels. Factors affecting the design and use of various audio-frequency connecting circuits are discussed in relation to the subjective effect of the results.

534.76 **2798**

The Formation of Stereophonic Images.—K. de Boer. (*Philips tech. Rev.*, Feb. 1946, Vol. 8, No. 2, pp. 51–56.) General discussion, with particular reference to the conditions under which sound must be recorded for stereophonic effects.

534.862 + 621.397 **2799**

S.M.P.E. [Society of Motion Picture Engineers] **Spring Technical Conference** [New York, May 1946].—(*See* 3087.)

621.317.79 : 621.395.82 : 621.395.645 **2800**

Intermodulation Testing [of audio-frequency amplifiers].—Hilliard. (*See* 2978.)

621.395.613.32 **2801**

Microphones: Part 4.—S. W. Amos & F. C. Brooker. (*Electronic Engng*, Aug. 1946, Vol. 18, No. 222, pp. 255–258.) An account of the theory and construction of the ribbon velocity-type microphone and of its performance compared with other types. Polar diagrams and response curves are given. Special B.B.C.-Marconi velocity types and combined pressure and velocity microphones are also described in detail. Conclusion of series; for previous parts see 2458 of September and back references.

621.395.623.8 **2802**

Beachmaster Announcing Equipment.—L. Vieth. (*Bell Lab. Rec.*, July 1946, Vol. 24, No. 7, pp. 261–263.) A general account. See also 532 of March (Duffield).

621.395.625 **2803**

Recording and Broadcasting of Preparations for Bikini Atom-Bomb Test.—A. A. Kees. (*Communications*, July 1946, Vol. 26, No. 7, pp. 11–13.) Outline of methods used to overcome technical difficulties of sound recording in aircraft and under difficult climatic conditions.

621.395.625.3 **2804**

Signal and Noise Levels in Magnetic Tape Recording.—D. E. Wooldridge. (*Trans. Amer. Inst. elect. Engrs*, June 1946, Vol. 65, No. 6, pp. 343–352.) Statistical variations in net flux entering the pole pieces, due to finite size of magnetic domains in the tape material, is the only source of noise completely explainable. Detailed consideration is given to hysteresis processes in the erase-record-reproduce cycle. The magnitude of overload signal is predicted in terms of the coercive force of the tape material and the reluctance of the magnetic circuit. A combination of a new vicalloy tape, the superposed h.f. method of recording, and a new unit design results in high quality recording from 100–8 000 c/s with a useful volume range of more than 50 db.

621.395.625.6 **2805**

Preliminary Sound Recording Tests with Variable-Area Dye Tracks.—R. O. Drew & S. W. Johnson. (*J. Soc. Mot. Pict. Engrs*, May 1946, Vol. 46, No. 5, pp. 387–404.) Measurements on frequency response, noise, and distortion, with photocells having various spectral response curves.

621.395.625.6 : 621.383 **2806**

Behavior of a New Blue-Sensitive Phototube [for black-and-white or colour film tracks] **in Theater Sound Equipment.**—J. D. Phyfe. (*J. Soc. Mot. Pict. Engrs*, May 1946, Vol. 46, No. 5, pp. 405–408.)

621.395.625.6 : 621.383 **2807**

A Phototube for Dye Image [colour film] **Sound Track.**—Glover & Moore. (*See* 3076.)

AERIALS AND TRANSMISSION LINES

621.315.1.056.1 **2808**

Tensions in Hanging Wires.—G. Hookham. (*Engineering, Lond.*, 17th May 1946, Vol. 161, No. 4192, p. 460.) Geometrical construction for tensions at the ends of fairly taut wires, with known sag.

621.315.21.029.5/.6 **2809**

Design Data and Characteristics of High-Frequency Cables: Parts 1 & 2.—K. Zimmermann. (*Radio, N.Y.*, May & June 1946, Vol. 30, Nos. 5 & 6, pp. 13–15 & 20 . . 34.) Cables for centimetre wavelengths require rigid mechanical and electrical specifications. Design data for obtaining a suitable characteristic impedance and attenuation with the required strength and flexibility are given for the following types: (1) Coaxial cable with stranded inner conductor and low-loss dielectric. (2) Coaxial cable, air-spaced by means of a spiral of polythene. (3) High impedance cable having a spiral inner conductor. (4) Dual coaxial for a high degree of balance. (5) Screened twin cable. (6) Twin unscreened. The second part discusses causes of attenuation, the power rating, and typical design problems.

621.315.21.029.6 : 621.317.3 **2810**

Measurement of Velocity of Propagation in Cable.—Kramer & Stolte. (*See* 2977.)

621.315.212.1.017 **2811**

Current Rating of Single-Core Paper-Insulated Power Cables.—C. C. Barnes. (*Elect. Comm.*, March 1946, Vol. 23, No. 1, pp. 70–95.) An outline of a method for computing the ratings. The effect of sheath losses, skin effect, proximity effect, and dielectric loss, are discussed in detail. Current rating for special cases of cables in water, air, and ducts, and for particular types of cables are calculated and tabulated.

621.315.221 : 669.45 **2812**

[Chemical] **Analysis of Cable Sheathing Alloys.**—Hamilton. (*See* 2947.)

621.315.229 **2813**

Jacketing Materials for High-Frequency Transmission Lines.—Warner. (*See* 2929.)

621.319.7 : 621.392 **2814**

Some Applications of Field Plotting.—E. O. Willoughby. (*J. Instn elect. Engrs*, Part III, July 1946, Vol. 93, No. 24, pp. 275–293.) "By the process of field-plotting in the cross-section of a uniform transmission line, an orthogonal field pattern of curvilinear squares satisfying the boundary conditions is obtained. If N_v is a number of voltage steps and N_f the number of electrostatic flux lines in this field plot, the characteristic impedance is given by

$$Z = 377(N_v/N_f)\sqrt{\mu/\kappa}$$

where μ is the permeability, and κ is the permittivity.

"Applications to coupling and screening are also considered.

"The use of models in an electrolytic tank for capacitance determination from field plots or direct measurement is discussed, and an axially symmetrical three-dimensional field is plotted. Mention is made of the relaxation process and rubber-sheet methods of field-plotting."

621.392 + 621.316.35.011.3 **2815**

Formulas for the Inductance of Coaxial Busses Comprised of Square Tubular Conductors.—H.P. Messinger & T. J. Higgins. (*Trans. Amer. Inst. elect. Engrs*, June 1946, Vol. 65, No. 6, pp. 328–336.)

621.392 + 621.396.11 **2816**

Propagation of Electromagnetic Waves Along a Single Wire.—Vladimirski. (*See* 3008.)

621.392 **2817**

Characteristic Impedance of Balanced Lines.—P. J. Sutro. (*Electronics*, July 1946, Vol. 19, No. 7, p. 150.) Three equations for the Z_0 of a balanced two-wire transmission line with cylindrical shield are compared, and expressions given for the errors in each equation.

621.392 **2818**

Anomalous Attenuation in Waveguides.—J. Kemp. (*Wireless Engr*, Aug. 1946, Vol. 23, No. 275, pp.

211–216.) " The puzzling phenomenon of decreasing attenuation constant with increasing frequency which occurs in a few isolated instances is here elucidated by treating the guides concerned as limiting cases of a guide of more general shape, in the interior of which the waves display the normal properties characteristic of waves in guides generally. The equations of the electromagnetic field, cut-off frequency and attenuation constant describing the isolated cases are then, in like manner, deduced as limiting cases from those appropriate to a guide of general shape. The isolated cases thus lose their character of isolation and assume that of straightforward limits instead. According to the point of view developed in the paper these limiting cases imply an electromagnetic field which extends to infinity along one of the transverse co-ordinates but, being wrapped around the axis of the guide, the field is constrained to exist in finite space where it continues to display the properties characteristic of a field of infinite extent."

621.392 : 621.396.67 **2819**

Aerial-to-Line Couplings.—Burgess. (*See* 2835.)

621.392.43 **2820**

Transmission Lines as Impedance Transformers.—L. R. Quarles. (*Communications*, July 1946, Vol. 26, No. 7, pp. 20 . . 38.) The solution of typical problems involving the quarter-wave line and open- and shorted-stub matching. The use of the circle diagram is explained. The last of a series; for previous parts see 2478 and 2480 of September.

621.396.67 **2821**

Aerials.—" Cathode Ray ". (*Wireless World*, July 1946, Vol. 52, No. 7, pp. 223–225.) Elementary theory of radiation from current elements.

621.396.67 **2822**

The Radiation Field of an Unbalanced Dipole.—W. Kelvin. (*Proc. Inst. Radio Engrs, W. & E.*, July 1946, Vol. 34, No. 7, pp. 440–444.) A method for obtaining the magnitude of the electric field in the distant zone of a symmetrical dipole with unequal branch currents is described. The result involves two functions of the vertical angle, plots of which are given for four values of h, the half-length of the dipole. Curves of the distant-zone electric field are given for values of h and of k, the ratio of the branch currents at the driving points. Experimental field patterns are plotted for several dipole lengths.

621.396.67 **2823**

Slotted Tubular Antenna for 88 to 108 Mc/s.—C. R. Jones. (*Communications*, July 1946, Vol. 26, No. 7, pp. 36 . . 39.) Short technical description of an aerial designed by A. Alford for horizontal polarization.

621.396.67 **2824**

Three New Antenna Types and Their Applications.—A. G. Kandoian. (*Elect. Comm.*, March 1946, Vol. 23, No. 1, pp. 27–34.) Reprint of 1180 of May.

621.396.67 : 538.56 **2825**

On the Excitation of Vibrators in Antennae.—M. A. Leontovich & M. L. Levin. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 3, pp. 156–163. In Russian.) Complete paper, of which an English summary was abstracted in 2618 of 1945.

621.396.67 : 621.397.6 **2826**

C.B.S. Tele Antenna.—O. J. Sather. (*Electronic Industr.*, July 1946, Vol. 5, No. 7, pp. 68–69.) Design and constructional details of a folded dipole video radiator for operation at 51.25 Mc/s. A heater is provided for removing ice.

621.396.677 **2827**

An Inexpensive 3-Element [rotating] **Beam** [antenna] **for 28 Mc/s.**—C. E. Nichols. (*QST*, Aug. 1946, Vol. 30, No. 8, pp. 27–31, 126.) Constructional details.

CIRCUITS

621.3.011.2 **2828**

Impedance Calculations.—H. Horwood. (*Elect. Rev., Lond.*, 31st May 1946, Vol. 138, No. 3575, pp. 846–847.) Graphical method for impedances in parallel.

621.3.012.3 **2829**

System of Graphing Capacities and Inductances.—A. S. Runciman. (*Elect. Engng, N.Y.*, June 1946, Vol. 65, No. 6, p. 300.)

621.3.012.3 **2830**

Nomograph Construction : Part 1 — Nomograph for Current, Voltage and Resistance.—F. Shunaman. (*Radio Craft*, June 1946, Vol. 17, No. 9, pp. 609 . . 633.)

621.314.2.029.5 : 621.396.619.018.41 **2831**

The Theory and Design of Intermediate-Frequency Transformers for Frequency-Modulated Signals.—H. A. Ross. (*A.W.A. tech. Rev.*, March 1946, Vol. 6, No. 8, pp. 447–471.) The design criteria are shown to be (*a*) the amount of a.m. introduced into the f.m. signal by the selective circuits, and (*b*) the linearity of the phase-angle/frequency characteristic of the secondary current. Maximum linearity is obtained when the transformers are critically coupled. The characteristic remains almost linear with a small degree of over-coupling, and the design of over-coupled transformers is discussed. Design charts are given for critically coupled transformers. The power relations in an f.m. signal which has been subjected to transmission through selective circuits are also discussed.

621.316.578.1 **2832**

One Tube—One Relay Multi-Time Circuits.—V. Wouk. (*Electronic Industr.*, July 1946, Vol. 5, No. 7, pp. 48–52, 98.) A single thyratron is used to perform multiple timing operations by the addition of RC combinations to the grid and anode circuits. A typical single or repeating two-interval timer provides interval ranges from 0.05 sec to 3 min and 0.07 sec to 10 sec. Details are given of multiple-interval timers.

621.385 : 621.396.822 **2833**

Fluctuations in Electrometer Triode Circuits.—A. van der Ziel. (*Physica, Eindhoven*, Feb. 1942, Vol. 9, No. 2, pp. 177–192. In English.) " The influence of fluctuations on the accuracy of measurement of small currents by an electrometer triode is investigated theoretically and the results compared with earlier theoretical and experimental work. Only two sources of fluctuations are important, thermal noise in the input circuit, and the shot effect of the grid current. The mean-square error is calculated for three methods of measurement: first, when the final deflexion of the galvanometer in the anode circuit is read once, second, when the deflexion is averaged over a long time, and third, when the input circuit resistance R_g is unusually high ($10^{14}\Omega$) and the increase of deflexion in a given time is observed. It is found that in the latter case the [root] mean square error is only about 2.10^{-18} A."

621.392 **2834**

On Approximate Integration of van der Pol's Equation.—V. V. Kazakevich. (*C. R. Acad. Sci. U.R.S.S.*, 30th Nov. 1945, Vol. 49, No. 6, pp. 414–417. In English.) Mathematical note on a method of approximate investigation of nonlinear systems. The method enables the process of establishment, the form, and the period, to be determined, and " is easy to modify for application to non-oscillatory systems ".

621.392 : 621.396.67 **2835**

Aerial-to-Line Couplings.—R. E. Burgess. (*Wireless Engr*, Aug. 1946, Vol. 23, No. 275, pp. 217–221.) " In the present paper two systems are considered : (*a*) the constant-resistance network, and (*b*) the cathode follower. The overall loss in signal/noise ratio for these systems is compared with that which occurs for direct connexion of the aerial to the line. The loss which occurs at the receiving end of the line is likely to be smaller and more constant with coupling networks at the sending end which match to the line than for direct connexion.

" Criteria are derived to show in what conditions each of the systems is preferable and these are expressed in terms of the line attenuation αl and the ratio of the aerial reactance to the characteristic impedance of the line ; *i.e.*, $|X|/R_0$. It is found that when $|X|/R_0$ is less than about unity, direct connexion is best unless the line attenuation is very large, in which case the constant-resistance network may have an advantage. If $|X|/R_0$ is greater than about 3, the cathode follower is generally best, its superiority being the greater the larger the line attenuation. The conclusions of the analysis are considered to be valid for frequencies up to about 30 Mc/s, assuming the aerial to be substantially reactive over the range concerned.

" A numerical example for a typical case of a capacitive aerial operating over a wide range of frequency is given."

621.392.41.015.3 : 517.512.4 **2836**

On Transients in Homogeneous Ladder Networks of Finite Length.—W. Nijenhuis. (*Physica, Eindhoven*, Sept. 1942, Vol. 9, No. 8, pp. 817–831. In English.) The problem considered is that of the voltage and current distribution in a finite homogeneous ladder network of n T-sections with lumped constants, resulting from the application of an impulse voltage at the input end, the network being short circuited at the other end. It is shown that solutions may be obtained in two different forms, closely analogous to the two solutions for the vibration of a stretched string, due respectively to d'Alembert and Euler and to Bernoulli. A brief historical account is given of the stretched-string problem, and the electrical problem is then solved in general terms by the use of the Laplace transformation.

The case of a low-pass filter is discussed in detail and the solution developed in its two forms, one consisting of a series of Bessel functions and corresponding to the d'Alembert-Euler solution, and the other a series of sine or cosine terms corresponding to the Bernoulli form. Comparison of these two forms gives an approximate Bessel function expansion in terms of a sine and cosine series. The approximation becomes progressively closer as the number of sections in the filter is increased.

A second case considered is that of a resistance-capacity ladder network for which the same differential equation applies as for the problem of diffusion. In this case equating the alternative forms of solution gives an expansion for Bessel functions with imaginary argument in terms of a sine and cosine series.

621.392.43 **2837**

Graphical Solution of Matching Problems.—G. Glinski. (*Electronic Industr.*, Aug. 1946, Vol. 5, No. 8, pp. 64–65.) Description of a simple design method, using circle diagrams, for matching with L, T, or π networks.

621.392.43 **2838**

Transmission Lines as Impedance Transformers.—Quarles. (*See* 2820.)

621.392.5 **2839**

Differentiating Circuit.—(*Wireless World*, July 1946, Vol. 52, No. 7, pp. 231–232.) Determination of suitable component values for a differentiating circuit with an exponential input-voltage waveform. Curves are given showing output wave-form as a function of component values. See also 3843 of 1945 (Ohman).

621.392.52 **2840**

Theory and Application of Parallel-T Resistance-Capacitance Frequency-Selective Networks.–L. Stanton. (*Proc. Inst. Radio Engrs, W. & E.*, July 1946, Vol. 34, No. 7, pp. 447–456.) A general treatment of the network including an account of its advantages and limitations, and dealing with its theory and applications. A single π-circuit is derived by means of star-delta transformations, and expressions are obtained for the network transmission and its phase shift at any frequency. Design considerations such as component tolerances and the effect of loading the network are discussed, and three examples, adjustable for resonant frequency and zero transmission, are given. A single-stage negative-feedback circuit is described to illustrate the application of the network.

621.394/.397].645 **2841**

Amplifier-Gain Formulas and Measurements.—S. J. Haefner. (*Proc. Inst. Radio Engrs, W. & E.*, July 1946, Vol. 34, No. 7, pp. 500–505.) Precise mathematical meanings are given to the usual definitions of amplifier gain. A practical method for measuring the insertion gain of a voltage amplifier is proposed, and the results on an actual amplifier are compared with those obtained from the usual definitions. It is concluded that " the gain of an amplifier " is meaningless unless the method of measurement is stated, and that the method used should have regard to the actual application of the amplifier.

621.394/.397].645.34 **2842**

Nyquist Diagrams for a Thompson System with Two Degrees of Freedom and Their Physical Interpretation.—K. Teodorchik. (*C. R. Acad. Sci. U.R.S.S.*, 10th Nov. 1945, Vol. 49, No. 4, pp. 259–262. In English.) A mathematical paper in which Nyquist's stability criterion is considered for linear and nonlinear regeneration circuits. "In a nonlinear system both the amplification coefficient μ and the phase angle ψ are variable not merely with the frequency p, but also with the output amplitude u_0. Therefore a nonlinear system is characterized by a family of Nyquist diagrams depending on a single parameter u_0 rather than by one diagram." See also 567 of March (Leonhard).

621.394/.397].822 + 621.392.6 **2843**

Suppression of Spontaneous Fluctuations in Amplifiers and Receivers for Electrical Communication and for Measuring Devices.—M. J. O. Strutt & A. van der Ziel. (*Physica, Eindhoven*, June 1942, Vol. 9, No. 6, pp. 513–527. In English.) From a general analysis of the signal/noise ratio of a linear 4-terminal network with linear feedback it is concluded that the ratio is unaffected by such feedback whether positive or negative. An equivalent circuit is derived for an amplifier with feedback and the optimum S/N ratio for an amplifier without feedback is calculated. The use of a suitable cathode-lead inductance to produce a "noiseless" input damping resistance for adjustment of bandwidth is described. Means of securing feedback of suitable sign in an amplifier to give a constant input impedance over a given frequency range are mentioned.

The use of a high grid resistance in an electrometer triode with feedback to give the required frequency characteristic enables enhanced accuracy of measurement to be obtained; similarly the thermal fluctuations in a galvanometer may be reduced.

The paper was noted in 2088 of 1943.

621.394/.397].822 + 621.392.6 **2844**

Suppression of Spontaneous Fluctuations in 2*n*-Terminal Amplifiers and Networks.—A. van der Ziel & M. J. O. Strutt. (*Physica, Eindhoven*, June 1942, Vol. 9, No. 6, pp. 528–538. In English.) This paper extends the earlier work (see 2843 above) on the reduction of fluctuations in amplifiers to the case of $2n$-poles. In section 2 the application of feedback of either sign on linear 6-poles is considered, and expressions are derived for the noise and signal voltages at the various outputs. Section 3 gives the theorem: the noise/signal ratio at every output can be reduced by feedback to the smallest value which exists at any output without feedback. Section 4 is concerned with the effect of various correlations between the fluctuations at the output on the optimum condition obtainable with feedback. In section 5 examples are given. Section 6 deals with the linear 8-pole and with the application of feedback to reduce the N/S ratio. Section 7 contains the extension of these results to linear $2n$-poles.

The paper was noted in 2089 of 1943.

621.395.645 **2845**

Three-Channel Amplifier: a 15-Watt Unit with Individual Control of Each Channel.—M. Contassot. (*Radio Craft*, June 1946, Vol. 17, No. 9, pp. 607.. 642.)

621.395.645 : 621.385.5 **2846**

Dynamic Characteristics of Pentodes.—S. J. Haefner. (*Communications*, July 1946, Vol. 26, No. 7, pp. 14–19.) Graphical analysis of their use in designing high-signal-level resistance-coupled amplifiers.

621.396.61 **2847**

Resonant Cavities.—L. J. Giacoletto. (*Electronic Industr.*, Aug. 1946, Vol. 5, No. 8, pp. 60–62.) Curves and data for the design of resonant cylindrical cavities.

621.396.61.029.58 **2848**

Variable Frequency Exciter Unit.—G. M. King. (*R.S.G.B. Bull.*, July 1946, Vol. 22, No. 1, pp. 10–11.) The circuit uses a Franklin type of oscillator tuning over the range 3.5–3.8 Mc/s, coupled through two buffer stages to an output stage which doubles or trebles the frequency. Frequency stability is comparable with that of a crystal-controlled oscillator.

621.396.611 **2849**

A Mechanical Model Analogous to an Oscillatory Electrical Circuit.—Blake. (*See* 3152.)

621.396.615 **2850**

Notes on the Stability of LC Oscillators.—N. Lea. (*J. Instn elect. Engrs*, Part III, July 1946, Vol. 93, No. 24, pp. 294–295.) Discussion of 569 of March.

621.396[.619 + .621.53 + .8 **2851**

The Calculation of Intermodulation Products by Means of a Difference Table.—A. Bloch. (*J. Instn elect. Engrs*, Part I, July 1946, Vol. 93, No. 67, p. 326.) Abstract of 2163 of August.

621.396[.619 + .621.53 + .8 **2852**

Modulation Products.—A. Bloch. (*Wireless Engr*, Aug. 1946, Vol. 23, No. 275, pp. 227–230.) "Tables and formulae for the calculation of modulation products from valve characteristics are given which are similar to those customarily used for the determination of the amplitude of harmonics from a series of equidistant ordinates. The derivation of the method is also described."

621.396.619.018.41 : 534.43 : 621.395.61 **2853**

Simplified Frequency Modulation.—G. G. Bruck. (*Proc. Inst. Radio Engrs, W. & E.*, July 1946, Vol. 34, No. 7, p. 458.) Description of a circuit, using a double triode as oscillator, amplifier, and discriminator, and having controlled negative feedback, which can be used as an f.m. gramophone-pickup circuit controlled by variation of capacitance to the needle.

621.396.622.72 **2854**

Oscillation Hysteresis in Grid Detectors.—E. E. Zepler. (*Wireless Engr*, Aug. 1946, Vol. 23, No. 275, pp. 222–227.) "The conditions under which grid-leak detectors employing variable regeneration may exhibit oscillation hysteresis are discussed. A theory covering the principal effects responsible for hysteresis is given, together with its experimental verification. Various measures against oscillation hysteresis are recommended."

621.396.645.029.63 **2855**

Power Amplifiers with Disk-Seal Tubes.—H. W. Jamieson & J. R. Whinnery. (*Proc. Inst. Radio Engrs, W. & E.*, July 1946, Vol. 34, No. 7, pp. 483–489.) Experimental data are given for frequencies between 200 and 3 000 Mc/s. In the 200-Mc/s region they agree well with class-C calculations using static characteristics. Amplifiers for 1 000 Mc/s are described, and factors limiting the performance at 3 000 Mc/s are discussed. Power gains up to 4 or 5 times and power outputs up to 17 W have been obtained at 3 000 Mc/s. Transit-time effects such as the back heating of the cathode by returned electrons may contribute to the poor performance at high frequencies.

621.396.662 **2856**

The Design of Band-Spread Tuned Circuits for Broadcast Receivers.—D. H. Hughes. (*J. Instn elect. Engrs*, Part I, July 1946, Vol. 93, No. 67, pp. 317–318.) Long abstract of 1803 of July.

621.397.64 **2857**

H.F. Wideband Amplifier.—(*Radio Craft*, June 1946, Vol. 17, No. 9, p. 645.) Sylvania i.f. chassis for television using 6AK5 valves, centre frequency 60 Mc/s, bandwidth 9 Mc/s.

539.16.08 + 621.318.572 **2858**

Electron and Nuclear Counters. [Book Review] —Korff. (*See* 3081.)

621.396.61 **2859**

Théorie des Oscillateurs. [Book Review]—Y. Rocard. France, 1941, 223 pp. (*Wireless Engr*, Aug. 1946, Vol. 23, No. 275, p. 233.) "This book can be heartily recommended to anyone seriously interested in the subject of oscillations."

GENERAL PHYSICS

523.755 : 539.1 **2860**

Possibility of Emission of a Very Hard Radiation from the Solar Corona.—J. S. Shklovsky. (*Nature, Lond.*, 22nd June 1946, Vol. 157, No. 3999, p. 840.)

530.145 **2861**

An Attempt to Formulate a Divergence-Free Quantum Mechanics of Fields.—G. Rayski. (*Nature, Lond.*, 29th June 1946, Vol. 157, No. 4000, p. 873.)

534.131 **2862**

Reflection and Refraction of Non-Stationary Elastic Waves.—V. Gogoladze. (*C. R. Acad. Sci. U.R.S.S.*, 20th Nov. 1945, Vol. 49, No. 5, pp. 322–325. In English.) "The present paper and [2863 & 2864 below] . . . contain a full treatment of the elastic wave reflection and refraction problem for arbitrary elastic media that are in contact along a plane. Also a theory of Rayleigh boundary waves is developed."

534.131 **2863**

On Rayleigh Boundary Waves.—V. Gogoladze. (*C. R. Acad. Sci. U.R.S.S.*, 30th Nov. 1945, Vol. 49, No. 6, pp. 400–403. In English.) A short mathematical paper on the spectrum of free vibrations of two different solid elastic media meeting along a plane. The necessary and sufficient condition for the existence of Rayleigh's boundary wave is established.

534.131 **2864**

General Formulae for the Reflexion and Refraction of Non-Stationary Elastic Waves.—V. Gogoladze. (*C. R. Acad. Sci. U.R.S.S.*, 10th Dec. 1945, Vol. 49, No. 7, pp. 479–481. In English.) Elastic disturbances may be considered as an aggregate of longitudinal and transverse waves reflected and refracted through real and complex angles in the plane of separation between elastic media, consequently, as an aggregate of homogeneous and non-homogeneous plane waves. General formulae for these waves are given. The horizontal component of energy flow in the non-homogeneous waves has a constant direction, while the vertical component "may change its sign with time and at different points". See also 2862 above.

535.234 **2865**

Planck's Radiation Formula.—D. G. Kendall: H. Dingle. (*Nature, Lond.*, 1st June 1946, Vol. 157, No. 3996, p. 737.) Demonstration by Kendall that Planck's radiation formula is not a unique solution of the general integral equation considered by Dingle (*Nature, Lond.*, 20th April 1946, Vol. 157, No. 3990, p. 515), and reply by Dingle.

535.313.2.08 **2866**

Screen-Line Tests of Paraboloidal Reflectors.—D. H. Hamsher. (*J. opt. Soc. Amer.*, May 1946, Vol. 36, No. 5, pp. 291–295.) Theoretical and practical considerations of testing optical reflectors by photographing by reflection an illuminated screen bearing ruled lines.

535.43 **2867**

Modified Rayleigh Scattering in a Liquid.—D. H. Rank. (*J. opt. Soc. Amer.*, May 1946, Vol. 36, No. 5, pp. 299–301.) Experimental investigation of the phenomenon of scattered light of modified frequency predicted by Brillouin. The λ3650 and λ4358 mercury lines were used, and scattering from benzene gave wavelength shifts in close agreement with the theoretical values.

535.434 **2868**

On the Theory of the Light Field in a Scattering Medium.—A. Gershun. (*C. R. Acad. Sci. U.R.S.S.*, 20th Dec. 1945, Vol. 49, No. 8, pp. 556–557. In English.) In a turbid medium where the illumination is due to scattered light, the relative distribution of intensity may be considered uniform in all directions. This leads naturally to the exponential law of attenuation of light with increasing depth.

In sea water the attenuation of daylight with increasing depth is determined almost completely by the true absorption.

535.61-15 : 536.45 : 546.3 **2869**

Infra-Red Emissivity of Metals at High Temperatures.—D. J. Price. (*Nature, Lond.*, 8th June 1946, Vol. 157, No. 3997, p. 765.) Measured between 1 000° and 1 500° C in a specially designed furnace.

537.523.4 **2870**

Incomplete Breakdown : a Cathode De-ionization Effect.—F. L. Jones. (*Nature, Lond.*, 13th April 1946, Vol. 157, No. 3989, p. 480.) The "stepped" nature of the voltage change observed across a spark gap using very clean electrodes is discussed. Introduction of fine dust particles of certain oxides on the cathode destroys the "stepped" phenomenon and permits full breakdown of spark-gap insulation. It is concluded that, for complete breakdown, continuous electron emission at or near the cathode is required during the whole breakdown process and not merely in the initial stages.

537.525 : 538.551.25 **2871**

Characteristic Electric Oscillations of a Low Pressure Mercury Arc.—B. L. Granovsky & L. N. Bykhovskaya. (*C. R. Acad. Sci. U.R.S.S.*, 20th Nov. 1945, Vol. 49, No. 5, pp. 339–342. In English.) Short account of experiments on oscillations in the frequency range 10^3–10^6 c/s in a circuit "consisting only of a constant e.m.f., ohmic resistance and discharge gap". In these experiments the discharge gap was a mercury arc and the existence of four different types of oscillation was established, (*a*) irregular deviations of the voltage from its normal value in the case of a freely moving cathode spot, (*b*) irregular oscillations at higher frequencies in the case of an anchored cathode spot, (*c*) regular oscillations in the low r.f. range (10^4–10^5 c/s), and (*d*) regular oscillations in the range of sound frequencies (3 000–300 c/s and lower). See also 2872 below.

537.525 : 538.551.25 **2872**

The Generation of High-Power Electric Oscillations by a Low Pressure Discharge.—B. L. Granovsky & T. A. Suetin. (*C. R. Acad. Sci. U.R.S.S.*, 30th Nov. 1945, Vol. 49, No. 6, pp. 410–413. In English.) Brief summary of results of a study of the generation of oscillations by gas discharge tubes having a perforated diaphragm or a narrow neck dividing the anode from the cathode regions (such tubes are here given the name " stenotrones "). The form of these oscillations depends on temperature, pressure, shape of tube, nature and density of gas discharge, and upon the external circuit. Frequencies of 15–100 kc/s and useful oscillatory powers up to 1 kW were obtained. See also 2871 above.

537.533.72 + 621.385.833 **2873**

Focusing of Electrons in Two Dimensions by an Inhomogeneous Magnetic Field.—K. Siegbahn & N. Svartholm. (*Nature, Lond.*, 29th June 1946, Vol. 157, No. 4000, pp. 872–873.) Description of a method combining several of the useful properties of the semicircular and lens methods of focusing β rays.

537.533.72 + 621.385.833 **2874**

Optical Characteristics of a Two-Cylinder Electrostatic Lens.—Goddard. (*See* 2998.)

537.533.72 + 621.385.833 **2875**

A Note on the Petzval Field Curvature in Electron-Optical Systems.—Goddard. (*See* 2999.)

537.564 **2876**

Stepped Ionization of Hydrogen by Electronic Impact.—B. Yavorsky. (*C. R. Acad. Sci. U.R.S.S.*, 10th Nov. 1945, Vol. 49, No. 4, pp. 250–253. In English.) Short mathematical paper on a method of computing the cross-section for ionization of the hydrogen atom.

537.591.5 **2877**

Mesotron Intensity as a Function of Altitude.—P. S. Gill. (*Nature, Lond.*, 25th May 1946, Vol. 157, No. 3995, p. 691.) A slight hump (maximum) occurs in the intensity/pressure curve at 500 mb.

538.1 **2878**

On Certain Non-Linear Phenomena resulting from the Superposition of Mutually Perpendicular Magnetic Fields.—G. S. Gorelik. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 4, pp. 172–188. In Russian.) Complete paper, of which an English summary was abstracted in 3073 of 1945.

538.11 **2879**

The Unit-Pole Definition of Magnetic Field Strength.—G. W. O. H. (*Wireless Engr*, Aug. 1946, Vol. 23, No. 275, pp. 207–210.) The problem of reconciling this definition with the fact that H is not a directly measurable quantity is discussed for media of permeability other than unity.

538.31 **2880**

On the Parametric Vibrations of an Iron Body in an Alternating Magnetic Field.—S. M. Rytoff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 3, pp. 150–155. In Russian.) Complete paper, of which an English summary was noted in 3074 of 1945. For another Russian version see 2546 of September.

538.56 : 530.12 : 531.51 **2881**

Radiation of Gravitational Waves by Electromagnetic Waves.—L. M. Brekhovskich. (*C. R. Acad. Sci. U.R.S.S.*, 10th Dec. 1945, Vol. 49, No. 7, pp. 482–485. In English.) The decrease in flux of electromagnetic energy due to gravitational radiation for a spherical e.m. wave is calculated for Einstein's cylindrical world and for a spherically isotropic world, and is found to be unobservable.

539.153 : 538.221 **2882**

Collective Electron Assemblies in a Metal with Overlapping Energy Bands : Part 1, General Theory ; Part 2, The Occurrence of Ferromagnetism.—W. Band. (*Proc. Camb. Phil. Soc.*, June 1946, Vol. 42, Part 2, pp. 139–144 & 144–155.) In Part 1 it is shown that, in a metal with overlapping energy bands, one of which is nearly full and the other nearly empty, there exists a critical temperature below which spontaneous magnetization will be present. In Part 2 it is shown that this concept is useful in systematizing the Curie-point data not only for pure ferromagnetic elements but also for the ferromagnetic alloys.

541.135 : 537[.226 + .228.2 **2883**

On the Dielectric Property and Electrostriction of Solutions of Electrolytes.—O. K. Davtjan. (*C. R. Acad. Sci. U.R.S.S.*, 20th Dec. 1945, Vol. 49, No. 8, pp. 575–577. In English.) A theoretical paper which establishes " that the change in the dielectric constant of a polar liquid consequent upon the dissolution of an electrolyte is proportional to its electrostriction ".

A formula is derived expressing the relation between the dielectric constant and concentration of an electrolyte. Satisfactory agreement with experimental data is found.

621.317.4 : 621.318.2 **2884**

The Magnetic Potentiometer Study of Permanent Magnets.—Bates. (*See* 2939.)

621.384 **2885**

On Resonance Phenomena Associated with the Movement of a Relativistic Particle in the Cyclotron.—A. Andronov & G. Gorelik. (*C. R. Acad. Sci. U.R.S.S*, 30th Dec. 1945, Vol. 49, No. 9, pp. 640–642. In English.) A theoretical analysis of the variation of energy of a charged particle with the intensity of magnetic field in a cyclotron. A resemblance to the curve of ferro-resonance is pointed out.

537 + 538](075) **2886**

Electricity and Magnetism for Students. [Book Review]—S. R. Humby. John Murray, London, 2nd edn. 1945, 6s. 6d. (*Nature, Lond.*, 1st June 1946, Vol. 157, No. 3996, p. 714.) " . . . Covers all the essential work for higher school certificate and university scholarship examinations, and treats the difficulties of electrostatic theory exceptionally well."

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.165 : 523.746 "1946.01/.02" **2887**

Cosmic Rays and the Great Sunspot Group of January 29 – February 12, 1946.—A. Duperier & M. McCaig. (*Nature, Lond.*, 13th April 1946, Vol. 157, No. 3989, p. 477.) Large variations in intensity of cosmic rays were observed during the passage of a large sunspot group, a large decrease in intensity coinciding with the peak of the associated magnetic storm.

523.7 **2888**

Magnetism of the Sun.—K. Mital. (*Sci. Culture*, June 1946, Vol. 11, No. 12, pp. 671–677.) A discussion of present-day knowledge and theoretical explanations of observed aspects of the sun's magnetic field. The field and polarity associated with sunspots, and convection currents in the sun itself are discussed. The relation of the general magnetic field to that of a uniformly magnetized sphere is examined.

523.72 **2889**

Cause Radio Disturbances.—(*Sci. News Lett., Wash.*, 20th April 1946, Vol. 49, No. 16, p. 245.) Clouds of electrically charged gases reaching the earth from the sun were discovered by a pulse ranging method during recent magnetic-ionospheric storms.

523.746 **2890**

The Magnetic Field of the Sun Spots.—L. E. Gurevich & A. I. Lebedinsky. (*C. R. Acad. Sci. U.R.S.S.*, 20th Oct. 1945, Vol. 49, No. 2, pp. 92–94.) Explanation of the magnetic field observed in sunspots, in terms of the flow of ionized gas towards the axis of the spot. The gas, crossing the initial (weak) field of the sun, has currents induced in it, resulting in an enhanced magnetic field along the axis of the spot. The field builds up slowly in a time comparable with the life of the spot.

523.746 : 621.396.11 : 551.51.053.5 **2891**

Sunspots and Radio Communication.—(*See* 3015.)

523.78 : 551.51.053.5 **2892**

Solar Eclipses and Radio Investigations of the Ionosphere.—Ya. L. Al'pert & B. N. Gorozhankin. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 2, pp. 85–108. In Russian.) Complete paper, of which an English summary was abstracted in 2521 of 1945.

523.78"1945.07.09" : 551.51.053.5 : 621.396.11 **2893**

On the Results of Radio-Observations during the Solar Eclipse (Corpuscular and Ultra-Violet) of July 9, 1945.—Ya. L. Al'pert & B. N. Gorozhankin. (*C. R. Acad. Sci. U.R.S.S.*, 10th Nov. 1945, Vol. 49, No. 4, pp. 254–258. In English.) Brief account of equivalent height and azimuth measurements on 3.8 Mc/s and 6 Mc/s over a sender-receiver distance of 37 km. The azimuth observations showed marked variations during the eclipse period, and it is suggested that these were due to bending of the F_2 layer during the optical eclipse. The results in general confirm the view that solar ultra-violet light governs *E*-layer ionization and " that the corpuscular radiation of the sun is not the agent determining the fundamental state of ionization of any of the regions of the ionosphere and that its action is purely perturbative in nature. . . . [However,] from the results of our experiments it may be concluded that the corpuscular radiation of the sun, in particular for particles with velocities of the order of 500 km/s, affects the ionosphere."

525.24 : 523.7 **2894**

Persistent Solar Rotation Period of 26.875 Days and Solar-Diurnal Variation in Terrestrial Magnetism.—J. Olsen. (*Nature, Lond.*, 11th May 1946, Vol. 157, No. 3993, p. 621.) Observations of the solar-diurnal variation in the horizontal force of the terrestrial magnetic field at Godhavn, Greenland, covering the years 1926–1940 establish a definite periodicity of 26.875 days. The effect vanishes in winter and has not been observed south of the auroral zone. Probable explanations are discussed.

550.37 : 621.315.28 **2895**

Earth Currents in Short Submarine Cables.—D. W. Cherry & A. T. Stovold. (*Nature, Lond.*, 8th June 1946, Vol. 157, No. 3997, p. 766.) Tests on submarine cables between Great Britain and the Continent earthed at the far shore show that voltages between cable and earth vary with the same periodicity as the tides.

550.38 **2896**

On the Origin of Terrestrial Magnetism.—J. Frenkel. (*C. R. Acad. Sci. U.R.S.S.*, 20th Oct. 1945, Vol. 49, No. 2, pp. 98–101. In English.) An hypothesis to explain the existence and magnitude of the earth's magnetic field is given in terms of convection currents set up in the core of the earth, which is assumed to be of molten metal of relatively low viscosity. These convection currents in the presence of a weak " adventitious " field give rise to a more powerful magnetic field by a process of " self-excitation ". The theory gives results which are high by a factor of 10 or even more compared with the observed values, but it is pointed out that the theory is incomplete and does not take account of many possibly important factors. See also 2890 above.

551.51.053.5 : 550.38 **2897**

On Currents in the Ionosphere which cause Variations in the Earth's Magnetic Field.—I. E. Tamm. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 2, pp. 30–41. In Russian.) Complete paper, of which an English summary was abstracted in 2523 of 1945.

551.51.053.5 : 550.38 **2898**

Two Anomalies in the Ionosphere.—E. V. Appleton. (*Nature, Lond.*, 25th May 1946, Vol. 157, No. 3995, p. 691.) Ionization in the F_2 layer is not symmetrical with respect to either geographic latitude or geographic longitude. Geomagnetic influences in the F_2 layer are suggested by the symmetry which obtains when magnetic dip is used in place of geographic latitude as a basis of comparison with F_2 ionization.

551.51.053.5 : 621.396.11 **2899**

Ionosphere Storm Effects in the *E* Layer.—T. W. Bennington. (*Nature, Lond.*, 13th April 1946, Vol. 157, No. 3989, pp. 477–478.) During the course of, or just prior to, an ionospheric storm, a low-pitched " rumble " is heard from high-power transmitting stations within the skip zone. From the nature of the signals it is concluded that they are due to variations in the ionic clouds in the *E* layer, and that these clouds are affected by the corpuscular radiation from the sun which causes the ionospheric storm.

551.51.053.5 : 621.396.11 **2900**

Maximum Values of Radio Field Intensity on Vertical Reflection from the Ionosphere, and an Evaluation of the Coefficient of Reflection.—Kessenikh. (*See* 3014.)

551.51.053.5 : 621.396.11 **2901**

On the Refractive Index of an Ionized Gas (Ionosphere).—V. L. Ginsburg. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 2, pp. 76–84. In Russian.) Complete paper, of which an English summary was abstracted in 2517 of 1945.

551.51.053.5 : 621.396.91 **2902**

Ionosphere Measuring Equipment.—Sulzer. (*See* 2983.)

551.57 : 621.396.82 : 629.135 **2903**

Flight Research on Precipitation Static.—Cleveland. (*See* 3038.)

551.594.5 : 535.33 **2904**

The Auroral Spectrum.—S. K. Mitra. (*Nature, Lond.*, 25th May 1946, Vol. 157, No. 3995, p. 692.) The spectra of the aurora and of the luminescent night sky are compared with those of atmospheric gases in a discharge tube. In the tube, the glass walls absorb the products of bombardment, but in the upper atmosphere, these persist and cause radiation by interaction. Differences between the auroral and night-sky spectra are due to higher collision frequency at the level of the aurora.

LOCATION AND AIDS TO NAVIGATION

519.2 **2905**

The General Case of Locating a Point on a Plane by Three Angle Measurements.—Yudin. (*See* 2959.)

621.3(43) **2906**

German Industrial Techniques.—(*See* 2927.)

621.396.9 **2907**

The Military Application of Radar.—E. G. Bowen. (*Proc. Instn Radio Engrs, Aust.*, May 1946, Vol. 7, No. 5, pp. 4–10.) Lecture giving a popular description and the history of development of radar for ground, ship, and aircraft use. For report of previous lecture see 1854 of July.

621.396.9 **2908**

Rotary Wave Radar.—W. van B. Roberts. (*Electronics*, July 1946, Vol. 19, No. 7, pp. 130–133.) A general description of a continuous-wave radar system using circularly polarized waves. The system has advantages in low-power applications requiring minimum weight and bulk.

621.396.9 **2909**

Aircraft Radar.—V. Zeluff. (*Sci. Amer.*, May 1946, Vol. 174, No. 5, pp. 204–206.) A brief general description of teleran, GCA, lanac and loran.

621.396.9 **2910**

Demonstration of a Marine Radar Set.—(*Engineer, Lond.*, 28th June 1946, Vol. 181, No. 4720, pp. 583–584.) Primarily for short-range navigation, and complying with British Ministry of Transport specification. The set, now in quantity production, consists of scanner, console with receiver and p.p.i. display, transmitter, and motor generator set with control board. The wavelength of the set is in the 3-cm band, and the peak power is 50 kW. Manual control of scanning is provided for, and an automatic warning unit is fitted, giving audible warning of the presence of an object in any direction within range limits 3 000–6 000 yd.

621.396.932 **2911**

Radio Aids to Marine Navigation.—(*Engineer, Lond.*, 10th May 1946, Vol. 181, No. 4713, pp. 425–427.) A brief description of direction-finding systems and the shipborne radar installed on H.M.S. Fleetwood for a trial blind run in the Solent.

621.396.932[.933].24 **2912**

Consol.—J. E. Clegg. (*Wireless World*, July 1946, Vol. 52, No. 7, pp. 233–235.) A description of a long-range radio navigational aid. Seventy-four beams are produced by three aerials on a two-mile baseline, the field being divided into areas of " dot " and " dash " modulation. The equisignal beams are rotated through about 10 degrees per minute, and the time at which the beam passes through the receiving station (measured in terms of the number of dots and dashes received since the last marking signal, a continuous tone) indicates the bearing from the transmitter. Maps and charts are provided at the receiving station for the interpretation of bearings.

The operational frequency range is 260–420 kc/s, the reliable range 1 000 miles over sea and 600 miles over land, by day, with an accuracy of about 0.3°. At night the range is increased and the accuracy reduced to 1–3°, depending on the sector. Ambiguities on bearing are normally easy to resolve by the use of other available data.

621.396.933.2 **2913**

Evaluation of Night Errors in Aircraft Direction Finding, 150–1 500 Kilocycles.—H. Busignies. (*Elect. Comm.*, March 1946, Vol. 23, No. 1, pp. 42–62.) Description of a method by which a pilot can determine the accuracy of night bearings obtained by aircraft radio compass and the effect of the aircraft's passing through fields resulting from reflections from the *E* layer or from mountains. Night error on the ground and at altitude is discussed, considering the simultaneous presence of the direct wave, sky wave, and sky wave reflected from the ground. All cases of polarization are examined briefly to indicate the numerous effects which may be encountered, and a number of rules are given for direction finding at night over land and sea, with diagrammatic maps showing safe and unsafe areas of operation.

621.396.933.2 **2914**

Discussion on " A New Type of Automatic Radio Direction Finder ".— C. C. Pine : H. Busignies. (*Proc. Inst. Radio Engrs, W. & E.*, July 1946, Vol. 34, No. 7, p. 457.) Discussion of 3543 of 1945, referring to earlier patents issued to Busignies, with reply by Pine.

621.396.933.23 **2915**

Microwave Approach and Landing System.—W. T. Spicer. (*Electronic Industr.*, Aug. 1946, Vol. 5, No. 8, pp. 52–57.) Description of equipment for the blind landing of aircraft that carry only voice communication apparatus. It consists of two microwave radar sets : (*a*) search system on 3 000 Mc/s that gives a polar radar map of 30 miles radius, (*b*) precision system on 10 000 Mc/s that covers a sector 20° in azimuth and 7° in elevation over the runway, with 10 miles range, and gives azimuth, elevation, and range indications. The ground observer gives verbal instructions to the aircraft.

621.396.9 **2916**
Radar — Radiolocation Simply Explained. [Book Review]—R. W. Hallows. Chapman* & Hall, London, 140 pp., 59 figs., 7s. 6d. (*Elect. Rev., Lond.*, 31st May 1946, Vol. 138, No. 3575, p. 848.) " . . . not highly technical, but contains a clear exposition of the basic principles of the subject."

621.396.9 **2917**
Radar for Merchant Ships. [Book Review]—H.M. Stationery Office, 1946, 9d. (*Electrician*, 14th June 1946, Vol. 136, No. 3550, p. 1598.) Includes a specification suitable for adoption by manufacturers.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788.1 **2918**
A Knudsen Absolute Manometer.—S. E. Williams. (*J. sci. Instrum.*, July 1946, Vol. 23, No. 7, pp. 144–146.) Describes a new design. The gauge is capable of absolute measurement of pressures between 10^{-4} mm and 10^{-6} mm Hg.

531.788.6 **2919**
Thermocouple Vacuum Gage.—H. Robinson & M. C. Flanagan. (*Gen. elect. Rev.*, May 1946, Vol. 49, No. 5, pp. 42–44.) Description of the arrangement and performance of a direct-reading gauge for the 1–200 micron range.

531.788.7 **2920**
Application of the Ion Gage in High Vacuum Measurement.—H. E. Van Valkenburg. (*Gen. elect. Rev.*, June 1946, Vol. 49, No. 6, pp. 38–42.) An electronic control panel has been developed for use with the ionization gauges to give continuous and stable operation over the range 10^{-4}–10^{-8} mm Hg. Details are given of the stabilizing and protective circuits used, and practical operation is discussed.

535.215 : 546.3 **2921**
Photoelectric Properties of Metals in a Finely Divided State.—L. J. Reimert. (*J. opt. Soc. Amer.*, May 1946, Vol. 36, No. 5, pp. 278–283.) Investigation of black surfaces (produced by distillation at a pressure of several mm Hg) of Cd, Zn, Sb, over the wavelength range 0.24–0.44μ and of Na from 0.40–, 0.96μ. The dependence of the photoelectric output and the threshold on the nature of the surfaces is discussed.

535.37 **2922**
The Effect of Wave-Length Distribution on the Brightness of Phosphors.—R. T. Ellickson. (*J. opt. Soc. Amer.*, May 1946, Vol. 36, No. 5, pp. 261–264.) A simple graphical method is given for estimating the visual efficiency of the emitted light from a phosphor with an emission curve that can be represented by a Gauss error function.

535.37 **2923**
Light Sum of Phosphors under Thermal and Infra-Red Stimulation.—R. T. Ellickson. (*J. opt. Soc. Amer.*, May 1946, Vol. 36, No. 5, pp. 264–269.) Measurements show that the ratio of the light sums obtained by infra-red irradiation or by heating the phosphor can vary from 1 to 30 according to the phosphor. This effect should be taken into account in using glow curves to determine the electron trap distributions in phosphors.

538.213 : 546.74 : 538.56.029.64 **2924**
Magnetic Permeability of Nickel in the Region of Centimetre Waves.—I. Simon. (*Nature, Lond.*, 1st June 1946, Vol. 157, No. 3996, p. 735.) μ decreases from 7.7 at $\lambda = 20$ cm to 1.2 at $\lambda = 3.2$ cm as measured on films 1 000–2 000 Å thick. The static permeability was found to decrease from 22 for 2 300 Å thickness to unity at zero thickness.

546.32.85 + 546.39.85] : 537.228.1 **2925**
ADP and KDP Crystals.—W. P. Mason. (*Bell Lab. Rec.*, July 1946, Vol. 24, No. 7, pp. 257–260.) Piezoelectric crystals of ammonium dihydrogen phosphate containing no water of crystallization are recommended for use as a substitute for Rochelle salt. The isomorphous salt potassium dihydrogen phosphate has similar properties, and the crystal structure is discussed. See also 1260 of May (Mason).

549.6 : 661.312.1 : 66.083.4 **2926**
Action of Water and Potassium Solutions under Pressure on Various Kinds of Silica.—J. Wyart. (*C. R. Acad. Sci., Paris*, 4th June 1945, Vol. 220, No. 23, pp. 830–832.) A brief account of a study of the crystalline forms appearing as a result of the action of water and of 0.01 mol KOH on fused silica.

621.3(43) **2927**
German Industrial Techniques.—(*Electronics*, July 1946, Vol. 19, No. 7, pp. 200 . . 206.) Notes on a number of developments connected with wired wireless, deposition of metallic films, radar, and ceramics.

621.3.017[.143 + .39 **2928**
Several After-Effect Phenomena and Related Losses in Alternating Fields.—J. L. Snoek & F. K. du Pré. (*Philips tech. Rev.*, Feb. 1946, Vol. 8, No. 2, pp. 57–64.) A survey of the causes and effects of the phenomena in dielectrics and ferromagnetic materials.

621.315.229 **2929**
Jacketing Materials for High-Frequency Transmission Lines.—A. J. Warner. (*Elect. Comm.*, March 1946, Vol. 23, No. 1, pp. 63–69.) The relative merits of a number of plastics and other materials are discussed. Test procedures are also outlined. See also 631 of March (Warner).

621.315.3 **2930**
Methods of Removing the Insulating Film from Formex Wire.—E. J. Flynn & G. W. Young. (*Gen. elect. Rev.*, June 1946, Vol. 49, No. 6, pp. 8–15.) Tests on various types of solvent give the following results : aqueous solutions of salts and alkalis are ineffective ; liquid organic mixtures with ammonium hydroxide, formic acid solutions, and certain acid pastes are rapid and do not cause corrosion, but need care in handling ; immersion in certain molten compounds, *e.g.* glass or solder, is extremely rapid ; of these 50–50 lead-tin solder at a temperature just over 500° C has proved most generally useful. Data and necessary precautions are stated for all the methods investigated.

621.315.61 : 546.287 **2931**

New Electrical Materials — I.—(*Electrician*, 9th Aug. 1946, Vol. 137, No. 3558, pp. 383–386.) Notes on organo-silicon compounds, including silicones.

621.315.61 : 621.396 **2932**

New Dielectric and Insulating Materials in Radio Engineering.—(*Engineer, Lond.*, 7th June 1946, Vol. 181, No. 4717, pp. 519–520.) Report of I.E.E. discussion on new r.f. insulating materials, particularly hydrocarbon plastics and ceramics. Disadvantages of the hydrocarbons are their widely varying mechanical properties and their low temperature-resistance. Progress is being made in overcoming these deficiencies. Magnesium silicate derivatives are used in ceramics, and a closer study of titanium dioxide has yielded better capacitor dielectrics. Titanates of the alkaline earth metals offer scope for development. For another account see *Electrician*, 7th June 1946, Vol. 136, No. 3549, pp. 1519–1520.

621.315.611 **2933**

The Formation of Ionized Water Films on Dielectrics under Conditions of High Humidity.—R. F. Field. (*J. appl. Phys.*, May 1946, Vol. 17, No. 5, pp. 318–325.) " When a dielectric is placed in an atmosphere of 100 per cent relative humidity, an ionized film of water forms, whose conductivity at the end of one minute is within a factor of ten of its equilibrium value, which is usually attained within an hour. This equilibrium conductivity ranges from essentially zero for certain hydrocarbon waxes, silicone resins and silicone-treated glass to 100 micromhos for ordinary glass and quartz. The ionized water film also produces interfacial polarization at its interface with the dielectric, which produces a marked increase in both capacitance and dissipation factor at audio frequencies. This polarization builds up in the same manner as the conductivity. Its relaxation frequency appears to be in the audio range."

621.315.613.1 **2934**

Physical Properties of Mica.—(*Nature, Lond.*, 22nd June 1946, Vol. 157, No. 3999, pp. 849–850.) Survey of American work leading to the conclusion that none of the species of mica has fixed and reproducible physical properties, since these are largely dependent on heat treatment, presence of impurities, and other factors. Main reference is to work of Hidnert & Dickson (1559 of June).

621.315.613.8.011.5 : 546.431.824 **2935**

Dielectric Constant of Barium Titanate as a Function of Strength of an Alternating Field.—B. M. Wul & I. M. Goldman. (*C. R. Acad. Sci. U.R.S.S.*, 30th Oct. 1945, Vol. 49, No. 3, pp. 177–180. In English.) An experimental study has established that below a critical temperature (about 80° C) the dielectric constant varies with the applied electric field. The effect is not due to the production of ionization in the air enclosed in any pores in the material, but is due to a change in the physical properties of the substance. The critical temperature, which depends somewhat on the annealing process, corresponds to the temperature at which the dielectric constant reaches a maximum. It is suggested that below the critical temperature the substance is pyroelectric. An abrupt variation in the specific heat of the substance at about 125° C has also been observed.

621.315.616 **2936**

Synthetic Rubbers and Plastics : XI. (Part 2) Water and the High Polymer.—F. T. White. (*Distrib. Elect.*, July 1946, Vol. 19, No. 163, pp. 143–145.) Further discussion of factors affecting the water affinity of high polymers, with examples of behaviour for several types of molecular structure. For Part 1 of Section XI see 1560 of June. To be continued.

621.315.616.029.64 **2937**

Dielectric Behaviour of 'Polythene' at Very High Frequencies.—J. G. Powles & W. G. Oakes. (*Nature, Lond.*, 22nd June 1946, Vol. 157, No. 3999, pp. 840–841.) The power factor decreases for wavelengths below 10 cm ; polythene may be used with confidence as a low-loss dielectric at 1 cm wavelength. A graph shows measurements of power factor versus frequency over the range 10^{5}–2.10^{10} c/s.

621.315.616.9 : 536.41 **2938**

Thermal Expansion and Second-Order Transition Effects in High Polymers : Part 3—Time Effects.—R. S. Spencer & R. F. Boyer. (*J. appl. Phys.*, May 1946, Vol. 17, No. 5, pp. 398–404.) The apparent second-order transition in polystyrene is shown to be a rate-effect.

" At ordinary rates of heating below the apparent transition temperature, or at more rapid rates near and above the transition temperature, polystyrene exhibits a cubical thermal expansion coefficient of about 2.7×10^{-4} per °C, and this value is not dependent on the heating rate as long as it is rapid enough. This fact suggests that two mechanisms operate in the thermal expansion of polystyrene, at markedly different rates, one resulting in almost instantaneous expansion, even at room temperature, and the other being strongly temperature dependent and contributing to the expansion under normal rates of heating only at higher temperatures."

For previous parts see 3605 of 1944 and 350 of February.

621.317.4 : 621.318.2 **2939**

The Magnetic Potentiometer Study of Permanent Magnets.—L. F. Bates. (*Phil. Mag.*, May 1945, Vol. 36, No. 256, pp. 297–318.)

621.357.7 : [621.882.2/.3 **2940**

Clearance between Nut and Screw Prior to Plating.—J. Bradshaw. (*Electronic Engng*, Aug. 1946, Vol. 18, No. 222, p. 259.) The basis for calculations, with mnemonics and a table of values for B.A. and Whitworth threads.

621.357.7 : 669.55.6 **2941**

Electrodeposition of Tin-Zinc Alloys.—R. M. Angles. (*Engineering, Lond.*, 3rd May 1946, Vol. 161, No. 4190, p. 427.) Composition of the electrolyte, and precautions in application. Reference is made to an article by Angles & Kerr (2599 of September).

621.396.6 : 551.5 : 629.135 **2942**

The Effects of Atmospheric Conditions on Aircraft Radio Equipment.—Honnor. (*See* 3143.)

621.791.3 **2943**

Soft Solders.—L. G. Earle. (*Metal Ind., Lond.*, 18th & 25th May 1945, Vol. 66, Nos. 20 & 21, pp. 308–311 & 322–325.) Determination of jointing capacity by the Kollagraph.

621.791.3 : 669.65.4 **2944**

An Engineering Approach to Soldering with Tin-Lead Alloys : Part 1.—A. Z. Mample. (*Metals and Alloys*, March 1945, Vol. 21, No. 3, pp. 702–707.)

621.793 **2945**

Metal Coatings on Ceramics.—E. Rosenthal. (*Electronic Engng*, Aug. 1946, Vol. 18, No. 222, pp. 241–242, 262.) A review of methods used, with special reference to the advantages of the method of firing on a paint consisting of a mixture of precious-metal oxides (which reduce on heating) with a ceramic flux. See also 2613 of September (Wein).

668.31(213) **2946**

Fortified Glues.—(*Sci. Amer.*, May 1946, Vol. 174, No. 5, p. 203.) Resistant to tropical conditions.

669.45 : 621.315.221 **2947**

[Chemical] **Analysis of Cable Sheathing Alloys.**—G. M. Hamilton. (*Nature, Lond.*, 29th June 1946, Vol. 157, No. 4000, p. 875.) A method of dissolving lead alloy (sheathing) containing up to 2% tin, 0.8% antimony and 0.25% cadmium, with a solution of 30% hydrogen peroxide and glacial acetic acid.

679.5 **2948**

Development of Industrial Plastics.—(*S. Afr. Engng*, June 1946, Vol. 57, No. 6, pp. 132–133.) A history of the development of plastics with brief notes on the properties of some of the more recent melamine resins.

679.8.053 **2949**

A Simple Saw for Hard Materials [quartz etc.].—W. A. Wooster. (*J. sci. Instrum.*, June 1946, Vol. 23, No. 6, p. 131.)

539.23 **2950**

Thin Films and Surfaces. [Book Review]—W. Lewis. English Univ. Press, London, 70 pp., 15s. (*J. sci. Instrum.*, July 1946, Vol. 23, No. 7, p. 163.)

621.396.611.21 : 549.514.1 **2951**

Quartz Crystals. [Book Review]—R. A. Heising (Ed.). D. Van Nostrand, New York, 563 pp., $6.50. (*Electronic Industr.*, July 1946, Vol. 5, No. 7, pp. 110, 112.) Seventeen chapters by members of the Bell Telephone Laboratories. " . . . complete to the point of being exhaustive . . a valuable compendium of quartz crystal information."

679.5 : 621.3 **2952**

Plastics for Electrical and Radio Engineers. [Book Review]—W. J. Tucker & R. S. Roberts. Technical Press, Kingston, Surrey, 12s. (*Engineering, Lond.*, 24th May 1946, Vol. 161, No. 4193, p. 482.) Written with " informed judgment " and a " wide knowledge of the requirements of electronic equipment". A very favourable review. See also 1896 of July.

MATHEMATICS

517.512.4 : 621.392.41.015.3 **2953**

On Transients in Homogeneous Ladder Networks of Finite Length.—W. Nijenhuis. (*Physica, Eindhoven*, Sept. 1942, Vol. 9, No. 8, pp. 817–831. In English.) See 2836 above. Contains a sine series expansion for Bessel functions.

517.9 **2954**

On the Stability of Systems of Differential Equations.—R. Bellman. (*Proc. nat. Acad. Sci., Wash.*, June 1946, Vol. 32, No. 6, pp. 190–193.)

518.5 **2955**

Slide-Disk Calculator.—G. S. Merrill. (*Gen. elect. Rev.*, June 1946, Vol. 49, No. 6, pp. 30–33.) The most efficient measure of the dispersion of a set of measurements is given by the root-mean-square deviation from the arithmetic mean. The calculator, based on the theorem of Pythagoras, affords a quick and simple means of obtaining this result. See also 2956 below.

518.5 **2956**

A Circular Slide Rule.—J. R. Dempster. (*Science*, 19th April 1946, Vol. 103, No. 2677, p. 488.) For root-mean-square operations. See also 2616 of September (Morrell), and 2955 above.

518.5 : 517.512.2 **2957**

A Machine for the Summation of Fourier Series.—G. Hägg & T. Laurent. (*J. sci. Instrum.*, July 1946, Vol. 23, No. 7, pp. 155–158.) Principally for Fourier synthesis in X-ray crystallography.

518.5 : 621.38 **2958**

Super Electronic Computing Machine.—Burks. (*See* 2995.)

519.2 **2959**

The General Case of Locating a Point on a Plane by Three Angle Measurements.—M. I. Yudin. (*C. R. Acad. Sci. U.R.S.S.*, 10th Dec. 1945, Vol. 49, No. 7, pp. 472–475. In English.) An extension of the author's paper (*Bull. Acad. Sci. U.R.S.S., sér. géogr. et géophys.*, 1944, Vol. 8, Nos. 2/3, p. 96 on. In Russian.) to a case where the errors in angular measurement are not independent. Formulae are given which determine the position of the most probable point and the accuracy achieved. Aero-dynamical and aural direction-finding applications are mentioned.

519.251.8 **2960**

Linear 'Curves of Best Fit'.—A. E. W. Austen & H. Pelzer. (*Nature, Lond.*, 25th May 1946, Vol. 157, No. 3995, pp. 693–694.) Applicable when both parameters are subject to errors of measurement.

621.392 **2961**

On Approximate Integration of van der Pol's Equation.—Kazakevich. (*See* 2834.)

621.395.4 **2962**

The Probability Distributions of Sinusoidal Oscillations Combined in Random Phase.—M. Slack. (*J. Instn elect. Engrs*, Part I, June 1946, Vol. 93, No. 66, p. 278.) Abstract of 1908 of July.

MEASUREMENTS AND TEST GEAR

621.317.3.029.63/.64 **2963**

Radio Measurements in the Decimetre and Centimetre Wavebands.—R. J. Clayton, J. E. Houldin, H. R. L. Lamont & W. E. Willshaw. (*J. Instn elect. Engrs*, Part I, June 1946, Vol. 93, No. 66, pp. 279–282.) Long abstract of 1914 of July.

621.317.32 : 621.3.015.33 **2964**

The Influence of Irradiation on the Measurement of Impulse Voltages with Sphere-Gaps.—J. M. Meek. (*J. Instn elect. Engrs*, Part I, July 1946, Vol. 93, No. 67, pp. 318–319.) Long abstract of 2624 of September.

621.317.35 **2965**

Non-Inductive Wave Analyser Circuits of Constant Q.—H. G. Yates. (*Engineer, Lond.*, 7th June 1946, Vol. 181, No. 4717, pp. 515–516.) Vibration problems in engineering require a wave analyser to track the component vibrations to their sources, and use is made of an amplifier and resistance-capacity feedback bridge. Various modifications of this arrangement are dealt with briefly.

621.317.35 **2966**

Complex Waveforms.—H. Moss. (*Electronic Engng*, Aug. 1946, Vol.18, No. 222, pp. 243–250.) The general method of harmonic analysis is discussed, and Fourier expansions for a large number of waveforms are tabulated. Notes are given on the production of certain of these waveforms. Conclusion of series; for previous parts see 2244 of August and back references.

621.317.361 + 621.396.611.21 **2967**

Duplex Crystals.—(*Electronic Industr.*, Aug. 1946, Vol. 5, No. 8, pp. 63, 97.) See 1582 of June (Lane).

621.317.42 **2968**

A New Type of Magnetometer (Oersted-Meter).—I. L. Berstein. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 4, pp. 189–193. In Russian.) Complete paper, of which an English summary was abstracted in 2733 of 1945.

621.317.42 **2969**

Fluxmeter Method of Measurement.—H. A. Miller. (*Electrician*, 14th June 1946, Vol. 136, No. 3550, pp. 1577–1579.) The theory of the Grassot fluxmeter and the effect of a shunting resistance.

621.317.7 : 621.396.61 **2970**

Auxiliary Apparatus at the Amateur Station.—W. H. Allen. (*R.S.G.B. Bull.*, Aug. 1946, Vol. 22, No. 2, pp. 20–22.) Practical information on the construction of simple test equipment including absorption and heterodyne frequency meters, monitor, and artificial aerial.

621.317.725 : 621.385 **2971**

Historic Firsts: Vacuum-Tube Voltmeter.—(*Bell Lab. Rec.*, July 1946, Vol. 24, No. 7, pp. 270, 274.)

621.317.727 **2972**

Direct Current Potentiometers.—S. Holmqvist. (*Ericsson Rev.*, 1946, Vol. 23, No. 1, pp. 35–37.) Description of a new potentiometer in which accuracy of measurement is not affected by switch transition resistance. A modification is described for use in the measurement of two potential differences or currents.

621.317.76 **2973**

A Standard of Frequency and Its Applications.—C. F. Booth & F. J. M. Laver. (*J. Instn elect. Engrs*, Part III, July 1946, Vol. 93, No. 24, pp. 223–241.) An historical survey of the development of frequency standards, an analysis of the factors affecting their design, and a description of British Post Office apparatus giving frequencies known to $\pm 1 \times 10^{-8}$. This apparatus consists of one fork-controlled oscillator and four groups of three quartz oscillators (one group of AT-cut 1 000-kc/s plates, three of GT-cut 100-kc/s plates with various types of mounting). The oscillator outputs are selected to control frequency-dividers which reduce the frequency to 1 kc/s for driving phonic-wheel clocks, the errors of which are measured by comparison with Rugby (GBR) time signals, determined by astronomical observation. Three of the twelve quartz oscillators are calibrated directly in terms of time and the remainder are compared with them.

Details are given of the crystal holders, oscillator circuits, temperature-control arrangements, and methods of inter-comparison of the various oscillator frequencies.

621.317.761 **2974**

A Heterodyne Frequency Meter with Built-In Crystal Calibrator.—A. A. Jones. (*R.S.G.B. Bull.*, Aug. 1946, Vol. 22, No. 2, pp. 18–19.) A calibrated variable-frequency oscillator feeds a mixer stage followed by an a.f. amplifier. The v.f.o. has ranges 125–250 kc/s and 1–2 Mc/s enabling frequencies in the range 125 kc/s–20 Mc/s to be measured by heterodyning the signal of unknown frequency against harmonics of the v.f.o. A 1-Mc/s crystal oscillator gives selected check points at which the frequency calibration of the v.f.o. can be corrected by a trimming capacitor. Reading accuracy 1 part in 5 000.

621.317.761 : 621.396.712 **2975**

Measuring and Monitoring Broadcast Frequencies.—L. S. Cole. (*Electronics*, July 1946, Vol. 19, No. 7, pp. 110–111.) A harmonic of a multivibrator controlled by a signal received from the monitored station is beat against the signal from a standard-frequency transmission, and the frequency of the beat note is measured. The circuit of the multivibrator unit is given.

621.317.761.029.4 **2976**

Electronic Frequency Meter for L.F.—W. A. Roberts. (*Electronic Engng*, Aug. 1946, Vol. 18, No. 222, pp. 238–240.) The signal of unknown frequency is applied to two high-gain-pentode limiting stages, giving substantially square-wave output. Pulses obtained by differentiating are applied to a tube held at cut-off. The resulting anode current varies linearly with the frequency of the pulses, and a meter in the anode circuit is directly calibrated in frequency. Ranges 0–2 kc/s, 0–4 kc/s and 0–8 kc/s; the reading is substantially independent of signal waveform and amplitude. Circuit details are given.

621.317.79 : 621.315.21.029.6 **2977**

Measurement of Velocity of Propagation in Cable.—B. Kramer & F. Stolte. (*Electronics*, July 1946, Vol. 19, No. 7, pp. 128–129.) A variable-frequency oscillator (95–105 Mc/s) is loosely coupled to a parallel-tuned circuit in parallel with a valve voltmeter. The tuning of the oscillator is ganged with that of the coupled circuit so that the circuit resonates with the oscillator at all frequencies. A sample of cable of fixed length (150 cm for polythene dielectric) known to be 3/4 wavelength at about 100 Mc/s is connected in series with the coupled circuit, throwing the circuit off tune with the oscillator except at the frequency at which the cable is 3/4 wavelength long. The tuning is adjusted until the voltmeter gives a maximum reading, and the mean velocity in the cable, deduced from

$v = \lambda f$, is read from the directly calibrated tuning control. Estimated accuracy 2%.

621.317.79 : 621.395.82 : 621.395.645 **2978**

Intermodulation Testing [of audio-frequency amplifiers].—J. K. Hilliard. (*Electronics*, July 1946, Vol. 19, No. 7, pp. 123–127.) The principle of the method is the same as that given in 2641 of September (Pickering). The equipment is described with block diagrams. The results of tests on typical amplifiers are shown by graphs which illustrate the reduction of intermodulation with various improvements of amplifier design.

621.317.79 : 621.396.619 **2979**

A Percent [amplitude] **Modulation Meter.**—R. P. Turner. (*Radio News*, May 1946, Vol. 35, No. 5, pp. 43..121.) Constructional details of a direct-reading a.c.-mains-operated instrument.

621.317.79 : 621.397.62 **2980**

A Television Signal Generator : Part 3—R.F. Circuits and Monitors.—R. G. Hibberd. (*Electronic Engng*, Aug. 1946, Vol. 18, No. 222, pp. 251–253.) Detailed circuit of 45-Mc/s vision generator. The signal from a 7.5-Mc/s crystal oscillator is frequency-multiplied to 45 Mc/s and link-coupled to a push-pull suppressor-grid-modulated output stage. Five output sockets are provided, suitably isolated and matched to 100-ohm cable, and a monitor stage is incorporated in the output. A similar unit is used for the sound channel. Picture and waveform monitors are described for checking output quality and for rapid fault location. Conclusion of series; for previous parts see 2255 of August and 2646 of September.

621.318.5.083 **2981**

Induction Relay Testing.—C. G. Rumsam. (*Elect. Rev., Lond.*, 31st May 1946, Vol. 138, No. 3575, pp. 841–843.) Necessity for suitable precautions in test equipment when accurate timing checks of the relay are required.

621.385.3 : 621.396.822 **2982**

Fluctuations in Electrometer Triode Circuits.—van der Ziel. (*See* 2833.)

621.396.91 : 551.51.053.5 **2983**

Ionosphere Measuring Equipment.—P. G. Sulzer. (*Electronics*, July 1946, Vol. 19, No. 7, pp. 137–141.) Description, with circuit diagrams, of an equipment that sweeps the range 1-20 Mc/s in 30 sec. The transmitted frequency is obtained as the beat between a 30-Mc/s pulsed oscillator and a variable 31–50-Mc/s oscillator. The difference-frequency signal is amplified by an untuned wideband amplifier. The returning signal is beat with the 31–50-Mc/s signal to give 30 Mc/s before passing to a sensitive receiver.

621.317 **2984**

Alternating Current Measurements at Audio and Radio Frequencies. [Book Review]—D. Owen. Methuen, London, 2nd edn., 120 pp., 5s. (*Wireless Engr*, Aug. 1946, Vol. 23, No. 275, p. 233.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

537.228.1 : 612.087 **2985**

A Piezo-Electric Unit for General Physiological Recording.—J. L. Malcolm. (*J. sci. Instrum.*, July 1946, Vol. 23, No. 7, pp. 146–148.) Uses X- or A.T.-cut quartz crystal.

537.591 : [621.317.39.083.7 + 621.396.9 **2986**

New Cosmic Ray Radiosonde Techniques.—S. A. Korff & B. Hamermesh. (*J. Franklin Inst.*, May 1946, Vol. 241, No. 5, pp. 355–368.) The measuring instrument, weighing 119 lb, is raised by a cluster of seventy balloons. It consists of a neutron counter (ionization chamber) with three shields which are placed over the counter in sequence. Impulses from the counter are made to cause momentary cessation of a 2 000-c/s note modulating a v.h.f. transmitter of conventional design. Barometric indications of balloon height, and the beginning of each cycle of shield changes, are signalled by coded interruptions of the modulation. The ground equipment comprises a standard receiver and pen recorder. The equipment and the flight technique are described. For previous work see 29 of 1942 (Clarke & Korff).

539.16.08 : 614.84 **2987**

Electronic Fire and Flame Detector.—P. B. Weisz. (*Electronics*, July 1946, Vol. 19, No. 7, pp. 106–109.) Detects flames, sparks, and arcs by the use of a Geiger-Müller counter tube sensitive to ultraviolet light of wavelength shorter than 3 000 Å. The device is not sensitive to daylight or to light from glass-enclosed sources. The tube and associated circuits are described. The device is triggered *e.g.* by a match struck 60 feet away.

551.501 + 621.396.91 + 621.317.39.083.7 **2988**

Recent Advances in Meteorological Methods.—N. K. Johnson. (*Nature, Lond.*, 2nd March 1946, Vol. 157, No. 3983, pp. 247–250.) Early developments included the German radio buoy, and the determination of the position of storms by atmospherics. Upper winds are measured by means of balloons, carrying radio transmitters to enable their track to be plotted by d.f. technique, or carrying only reflectors for detection by radar. Radiosonde balloons are used to obtain information on the temperature, pressure, and humidity of the upper air. Reference is also made to observations taken in aircraft, and to the use of high-velocity shells for exploration of the stratosphere.

578.088.7 : 621.317.755 **2989**

Double-Beam C.R. Tube in Biological Research.—Bullock. (*See* 3072.)

621.317.39 : 620.172.222 **2990**

Electric Strain Gauges.—A. B. White. (*Elect. Rev., Lond.*, 2nd Aug. 1946, Vol. 139, No. 3584, pp. 175–176.) Description of the principles of operation of the resistance strain gauge. Use of cathode-ray tube technique for recording varying strains is outlined.

621.317.39 : 621.753.3 **2991**

Electronic Comparator Gage.—W. H. Hayman. (*Electronics*, July 1946, Vol. 19, No. 7, pp. 134–136.) Description, with circuit diagrams, of a device for converting the movement of the contact point of a mechanical gauge into a change of inductance in an r.f. circuit, giving an electrical indication. At its most sensitive setting the device gives readings to about 10^{-5} inch. Relays can be operated when measurements fall outside prescribed limits.

621.365[.5 + .92 **2992**

Radio-Frequency Heating. — L. Hartshorn. (*Nature, Lond.*, 11th May 1946, Vol. 157, No. 3993, pp. 607–610.) Substance of Royal Institution lecture. A non-technical description of the underlying principles of dielectric and induction heating, and some examples of their applications.

621.365.5 **2993**

Induction Heating of Long Cylindrical Charges.—H. F. Storm. (*Trans. Amer. Inst. elect. Engrs,* June 1946, Vol. 65, No. 6, pp. 369–377.) Further development of formulae deduced in a previous paper (981 of 1945) to include any radius of charge, and any depth of penetration, the generated heat being expressed in terms of a rapidly converging series. The analysis is applied to the case where the charge is subdivided into a number of cylindrical rods, and the optimum radius of rod for maximum inductor efficiency is deduced.

621.365.92 **2994**

Problems in the Design of High-Frequency Heating Equipment.—W. M. Roberds. (*Proc. Inst. Radio Engrs, W. & E.,* July 1946, Vol. 34, No. 7, pp. 489–500.) Discussion of the required coupling circuits. A simple analysis of a transformer-coupled circuit is given, and the advantages of close and loose coupling compared. A generator can be made more versatile if low-impedance tank circuits and loose coupling are employed.

621.38 : 518.5 **2995**

Super Electronic Computing Machine.—A. W. Burks. (*Electronic Industr.,* July 1946, Vol. 5, No. 7, pp. 62–67, 96.) A description of the Electronic Numerical Integrator and Computer (Eniac) with diagrams of some of the circuits. See also 1928 of July.

621.38 : 665.54 **2996**

Electronic Uses in Petroleum Refining.—(*Electronic Industr.,* July 1946, Vol. 5, No. 7, pp. 58 . . 106.) Electronic devices prove useful in catalytic petroleum processes where rapid and accurate means of following changes in complex chemical mixtures are necessary.

621.384 **2997**

Application of Pulse Technique to the Acceleration of Elementary Particles.—E. G. Bowen, O. O. Pulley & J. S. Gooden. (*Nature, Lond.,* 22nd June 1946, Vol. 157, No. 3999, p. 840.) May provide a cheap tool for studies in nuclear physics.

621.385.833 + 537.533.72 **2998**

Optical Characteristics of a Two-Cylinder Electrostatic Lens.—L. S. Goddard. (*Proc. Camb. Phil. Soc.,* June 1946, Vol. 42, Part 2, pp. 106–126.) "Explicit formulae are obtained for the focal lengths and the positions of the principal planes. These formulae involve the two parameters which completely specify the lens, namely, the voltage ratio σ and the gap width ϵ (the separation of the cylinders). . . Use of the method in conjunction with the relaxation method for determining electrostatic field distributions means that electrostatic electron optical systems of axial symmetry may be designed to a large extent in the office instead of in the laboratory."

621.385.833+537.533.72 **2999**

A Note on the Petzval Field Curvature in Electron-Optical Systems.—L. S. Goddard. (*Proc. Camb. Phil. Soc.,* June 1946, Vol. 42, Part 2, pp. 127–131.) The work of Glaser (2205 of 1941) is applied to obtain exact expressions for the Petzval field curvature in the case of both magnetic and electrostatic electron lenses. See also Klemperer & Wright (2483 of 1939) for similar work on a two-cylinder electrostatic lens.

778 : 537.533.8 : 621.386.1 **3000**

Secondary Electron Photography.—J. E. Roberts. (*Nature, Lond.,* 25th May 1946, Vol. 157, No. 3995, pp. 695–696.) Irradiation of printed matter with high-voltage X rays gives a positive image due to secondary emission of electrons from metallic ink particles.

621.38 : 6 **3001**

Electronics in Industry. [Book Review]—G. M. Chute. McGraw-Hill Book Co., New York, 1946, 461 pp., $5.00. (*Electronic Industr.,* Aug. 1946, Vol. 5, No. 8, p. 112.) " . . . prepared for instrumentation men and operating technicians in industry. . . ."

PROPAGATION OF WAVES

07(94) : 621.396.11 **3002**

Radio Propagation Bulletin : Council for Scientific and Industrial Research.—(*J. Instn Engrs Aust.,* March 1946, Vol. 18, No. 3, p. 61.) Notice of new Australian publication.

551.51.053.5 : 523.78"1945.07.09" : 621.396.11 **3003**

On the Results of Radio-Observations during the Solar Eclipse (Corpuscular and Ultra-Violet) of July 9, 1945.—Al'pert & Gorozhankin. (*See* 2893.)

551.51.053.5 : 523.78 **3004**

Solar Eclipses and Radio Investigations of the Ionosphere.—Al'pert & Gorozhankin. (*See* 2892.)

551.51.053.5 : 621.396.11 **3005**

Ionosphere Storm Effects in the *E* Layer.—Bennington. (*See* 2899.)

551.51.053.5 : 621.396.11 **3006**

On the Refractive Index of an Ionized Gas (Ionosphere).—Ginsburg. (*See* 2901.)

551.51.053.5 : 621.396.11 **3007**

Absorption of Radio Waves in the Ionosphere.—Ya. L. Al'pert & V. L. Ginsburg. (*Bull. Acad. Sci. U.R.S.S., sér. phys.,* 1944, Vol. 8, No. 2, pp. 42–67. In Russian.) Complete paper, of which an English summary was abstracted in 2514 of 1945.

621.396.11 + 621.392 **3008**

Propagation of Electromagnetic Waves along a Single Wire.—V. V. Vladimirski. (*Bull. Acad. Sci. U.R.S.S., sér. phys.,* 1944, Vol. 8, No. 3, pp. 139–149. In Russian.) Complete paper, of which an English summary was abstracted in 2533 of 1945.

621.396.11 **3009**

On a Certain Method of Solving Problems of Propagation of Electromagnetic Waves along the Surface of the Earth.—M. Leontovich. (*Bull. Acad. Sci. U.R.S.S., sér. phys.,* 1944, Vol. 8, No. 1, pp. 16–22. In Russian.) Complete paper, of which an English summary was abstracted in 2532 of 1945.

621.396.11 **3010**

The Propagation of Radio Waves along a Real Surface.—E. L. Feinberg. (*Bull. Acad. Sci. U.R.S.S., sér. phys.,* 1944, Vol. 8, No. 3, pp. 109–131. In Russian.) For an English version see 2529 of 1945. (In the second line of 2529 of 1945 "homogeneous" should read "inhomogeneous".)

621.396.11 **3011**

On the Effective Path of Radio Waves along the Ground.—E. L. Feinberg. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 3, pp. 132–138. In Russian.) For English version see 1962 of July.

621.396.11 **3012**

On the Theory of the Propagation of Radio Waves along a Real Surface.—E. L. Feinberg. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 4, pp. 200–209. In Russian.) Complete paper, of which an English summary was abstracted in 2531 of 1945.

621.396.11 : 551.5 **3013**

Radio Meteorology : Influence of the Atmosphere on the Propagation of Ultra-Short Radio Waves.—(*Nature, Lond.*, 29th June 1946, Vol. 157, No. 4000, pp. 860–862.) Summary of the proceedings of a joint conference of the Royal Meteorological Society and the Physical Society.

Appleton quoted instances of radar ranges beyond the geometrical horizon and showed that radio vision around the earth is possible when the lapse-rate of atmospheric refractive index is greater than 0.15×10^{-6} per metre. The most favourable combination for producing such an atmosphere is a temperature inversion associated with a lapse of water vapour pressure.

Sheppard "discussed the physical processes determining the vertical gradients of temperature and humidity in the bottom kilometre of the atmosphere."

Smith-Rose stated that there were indications that a simple theory was adequate to explain the observed fields of 9-cm and 3-cm waves over land and sea except for low-level links, and Booker discussed the duct process at these low levels.

Ryde stated that attenuation and back-scattering of centimetre waves ($\lambda \geqslant 2$ cm) due to water droplets (diam. d of order 10μ) is proportional to d^3. For drizzle and rain, scattering follows Rayleigh's law $[\propto (d/\lambda)^4]$. Attenuations of 3-cm waves up to 1 db per km in Britain and 6 db per km in the tropics are deduced. See also 1972 (Robertson & King) and 1973 (Mueller) of July.

621.396.11 : 551.51.053.5 **3014**

Maximum Values of Radio Field Intensity on Vertical Reflection from the Ionosphere, and an Evaluation of the Coefficient of Reflection.—V. N. Kessenikh. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 2, pp. 68–75. In Russian.) Complete paper, of which an English summary was abstracted in 2522 of 1945.

621.396.11 : 551.51.053.5 : 523.746 **3015**

Sunspots and Radio Communication.—(*J. Franklin Inst.*, May 1946, Vol. 241, No. 5, pp. 369–371.) The occurrence between 29th Jan. and 11th Feb. 1946, of one of the largest sunspot groups ever recorded was the cause of severe disturbances to radio propagation. Bright eruptions associated with the group gave rise to a number of sudden "fade-outs" varying in length from a few minutes to several hours. These are believed to be due to increased ionization in the D region of the ionosphere with resulting increase in absorption. The central meridian passage of the main spot was followed 24 hours later by severe magnetic and ionospheric storms associated with auroral displays. High-frequency radio communication, particularly across the North Atlantic, was considerably interfered with due to depression of F_2-layer critical frequencies and increased absorption.

621.396.11 : 551.51.053.5 "1946.07" **3016**

Short-Wave Conditions : Expectations for July.—T. W. Bennington. (*Wireless World*, July 1946, Vol. 52, No. 7, p. 222.)

621.396.11.029.63/.64 **3017**

Propagation of Short Radio Waves.—E. C. S. Megaw (mis-spelt Megan). (*S. Afr. Engng*, June 1946, Vol. 57, No. 6, p. 131.) Extracts from a paper read at the radiolocation convention of the I.E.E. For other accounts see 2576 of September and back reference.

621.396.67 **3018**

The Radiation Field of an Unbalanced Dipole.—Kelvin. (*See* 2822.)

RECEPTION

621.394/.397].822 + 621.392.6 **3019**

Suppression of Spontaneous Fluctuations in Amplifiers and Receivers for Electrical Communication and for Measuring Devices.—Strutt & van der Ziel. (*See* 2843.)

621.394/.397].822 + 621.392.6 **3020**

Suppression of Spontaneous Fluctuations in $2n$-Terminal Amplifiers and Networks.—van der Ziel & Strutt. (*See* 2844.)

621.394/.397].822 **3021**

Fluctuations of Electric Current.—D. A. Bell. (*J. Instn elect. Engrs*, Part I, June 1946, Vol. 93, No. 66, p. 275.) Long abstract of 1038 of April.

621.396.61/.62 **3022**

"Portarig" Ham Station.—Scott. (*See* 3098.)

621.396.61/.62].029.5 : 629.135 **3023**

A General-Purpose Radio-Communication Equipment for Military Aircraft.—W. W. Honnor & J. P. Blom. (*A.W.A. tech. Rev.*, March 1946, Vol. 6, No. 8, pp. 505–518.) Provides for transmission over frequency ranges 140–500 kc/s and 2–20 Mc/s with crystal control over parts of the h.f. range, and reception over the whole range 140–20 000 kc/s. Operation on c.w., m.c.w., and telephony is provided for, and d.f. and homing systems are incorporated. For more details of the receiver see 3032 below.

621.396.615 : 621.396.662 **3024**

Permeability-Tuned Oscillators.—Hunter. (*See* 3103.)

621.396.619 **3025**

F.M.–A.M. Conversion at U.H.F.—W. van Roberts. (*Electronic Industr.*, July 1946, Vol. 5, No. 7, p. 82.) The f.m. signal is passed through a waveguide slightly above the cut-off diameter. The attenuation in the pipe increases rapidly with increase in frequency, so that the emerging wave is amplitude-modulated. Summary of U.S. Patent 2 393 414.

621.396.621 + 534.43 **3026**

A New Radiogramophone — Svenskradio 1467.—C. Fredin. (*Ericsson Rev.*, 1946, Vol. 23, No. 1, pp. 44–47.) Specification and circuit diagram.

621.396.621 **3027**

Radio Data Sheet 336.—(*Radio Craft*, June 1946, Vol. 17, No. 9, p. 615.) Data for Belmont Radio Model 6D111, Series A.

621.396.621 **3028**

Sobell Type 615 [broadcast receiver]**.**—(*Wireless World*, July 1946, Vol. 52, No. 7, pp. 226–227.) Test report and circuit diagram.

621.396.621 **3029**

Ex-R.A.F. Communication Receiver.—“ Ex-Signals ”. (*Wireless World*, July 1946, Vol. 52, No. 7, pp. 212–216.) Description of R.A.F. receiver type R.1155, with practical details for converting it to civilian needs, including elimination of direction-finding circuit, construction of a power pack, and provision for loudspeaker operation. Circuit diagrams and component values of the receiver are included.

621.396.621 **3030**

An Amateur-Band Eight-Tube Receiver.—B. Goodman. (*QST*, Aug. 1946, Vol. 30, No. 8, pp. 13–18.) Constructional details of a communication-type receiver with frequency ranges limited to the amateur bands.

621.396.621 : 621.396.828 **3031**

[Methods of] **Reducing Hum Levels** [in mains receivers]**.**—J. King. (*Radio Craft*, June 1946, Vol. 17, No. 9, pp. 619..648.)

621.396.621.029.5 : 629.135 **3032**

A General-Purpose Communication Receiver for Military Aircraft.—J. B. Rudd & T. R. W. Bushby. (*A.W.A. tech. Rev.*, March 1946, Vol. 6, No. 8, pp. 519–527.) A more detailed description of the receiver section of the equipment described in 3023 above, with a schematic diagram.

621.396.621.029.5 : 629.135 **3033**

A Ten-Channel Aircraft Receiver.—J. B. Rudd. (*A.W.A. tech. Rev.*, March 1946, Vol. 6, No. 8, pp. 489–504.) A superheterodyne for either local or remote control on any one of ten crystal-controlled frequencies from 200 to 13 000 kc/s. Alternatively a manually tuned range covers 200-400 kc/s. A cathode-follower input circuit is used, and the beat oscillator may be remotely controlled.

621.396.621.029[.58 + .62 **3034**

F.M. and A.M. Receiver for Comparison Tests.—W. F. Frankart. (*Electronics*, July 1946, Vol. 19, No. 7, p. 168.) Brief description and circuit diagram. Tuning range 15–170 Mc/s, sensitivity 2 μV. The performance was improved by the use of germanium crystal diodes.

621.396.622 **3035**

Applying A.M.D. [audio-modulated detection] **to the Communications Receiver.**—D. A. Griffin & L. C. Waller. (*QST*, Aug. 1946, Vol. 30, No. 8, pp. 56–61..136.) Constructional details of an adaptor for a communication receiver comprising an audio oscillator, squaring amplifier, selective amplifier, and a power supply. For a discussion of the merits of the system see 2694 of September (same authors).

621.396.622.72 **3036**

Oscillation Hysteresis in Grid Detectors.—Zepler. (*See* 2854.)

621.396.682 : 621.396.621 **3037**

A.C./D.C. Voltage Dropping.—W.T.C. (*Wireless World*, July 1946, Vol. 52, No. 7, pp. 236–237.) The use of a series resistor for reducing the mains voltage applied to an a.c./d.c. series-heater receiver is unsatisfactory with a.c. mains. The rectifier conducts only at the peaks of the positive half-cycles and causes additional voltage drop at those periods. Adjustment of the dropping resistor to give correct effective heater current therefore gives too low a voltage for the h.t. supply. Two alternative schemes for overcoming this difficulty are suggested.

621.396.82 : 551.57 : 629.135 **3038**

Flight Research on Precipitation Static.—E. L. Cleveland. (*Electronic Industr.*, Aug. 1946, Vol. 5, No. 8, pp. 66–69, 94.) A general account of the causes, effects, and remedies. See also 1991/1993 of July and 2322, 2323 & 2344 of August (U.S. Army-Navy precipitation-static project).

621.397.823 **3039**

Tele[vision] **Interference : Parts 1 & 2.**—Goldsmith. (*See* 3097.)

621.396/.397].62 **3040**

Radio Receiver Design. Part 2 : Audio Frequency Amplifiers, Television and Frequency Modulated Receiver Design. [Book Review]—K. R. Sturley. Chapman & Hall, London, 1945, 480 pp., 28s. (*Nature, Lond.*, 8th June 1946, Vol. 157, No. 3997, p. 751.) This volume, with its companion, Part 1, “ forms a most useful work of reference for the radio engineer and designer ”. For other reviews see 414 of February and 728 of March.

STATIONS AND COMMUNICATION SYSTEMS

621.394/.396] “ 1846/1946 ” **3041**

Development in Teletechnics 1846–1946 : Tele-Signalling.—T. Ericsson. (*Ericsson Rev.*, 1946, Vol. 23, No. 2, pp. 150–160.)

621.394/.395] “ 1846/1946 ” **3042**

Developments in Teletechnics 1846–1946 : Telegraphy and Telephony.—N. Heden. (*Ericsson Rev.*, 1946, Vol. 23, No. 2, pp. 122–149.)

621.395.44 : [621.315.052.63 + 621.398 **3043**

New Carrier Frequency Systems for Telephony and Remote Metering and Control on Power Lines.—S. Rohde. (*Ericsson Rev.*, 1946, Vol. 23, No. 1, pp. 2–34.) A discussion of the fundamentals of carrier-frequency transmission over power lines leading up to a description of the Ericsson equipment giving telephone, teleprinter, remote metering, and control-signal facilities.

Single-sideband working is used with carrier frequencies in the band 50–150 kc/s ; different frequencies are used for receiving and transmitting telephony, and for the remote metering and control channels. The modulation and demodulation processes involved are explained. The terminal equipment, protective devices, and auxiliary equipment are described.

A telephone channel range of 300–400 km on a 220-kV line is obtained without repeaters.

621.395.44 **3044**

Three-Channel Carrier Telephone System for Open-Wire Lines.—T. Bohlin. (*Ericsson Rev.*, 1946, Vol. 23, No. 1a, pp. 50–70.) A detailed description of a modern system for carrier telephone communications. For distances up to 500 km only terminal equipment is required, but for long distances up to several thousand kilometres intermediate repeaters are inserted. Each channel uses a frequency band of 300–2 700 c/s, and transmission and reception occupy the whole range from 6 kc/s to 30 kc/s, different frequencies being used in different directions. Attenuation curves are given, and the effect of wet and dry weather indicated.

621.395.64 **3045**

Rural Line Repeater with Negative Feedback.—J. Ljungberg. (*Ericsson Rev.*, 1946, Vol. 23, No. 1a, pp. 71–74.) The equipment consists of 2-wire repeaters which can be connected to the mains, and is suitable for use where a normal repeater station is not warranted.

621.395.823 **3046**

Practical Aspects of Telephone Interference arising from Power Systems.—P. B. Frost & E. F. H. Gould. (*J. Instn elect. Engrs*, Part I, June 1946, Vol. 93, No. 66, pp. 255–274.) Experimental paper divided into six sections. (1) Electromagnetic induction at fundamental frequency; good agreement between calculated and measured values of induced voltage usually obtains; (2) interference at audio frequencies; mainly from faulty power lines due to induction of harmonic components; (3) multiple earthing of high-voltage systems; (4) multiple earthing of low-voltage systems; (5) apparatus developments; gas-discharge tubes, noise-eliminating filters, improved psophometer; (6) rise of earth potential; damage produced near faults in power systems.

621.396 " 1846/1946 " **3047**

Developments in Teletechnics 1846–1946 : Radio-Technics.—T. Övergaard. (*Ericsson Rev.*, 1946, Vol. 23, No. 2, pp. 161–174.)

621.396.13 **3048**

A Preview of the Western Union System of Radio Beam Telegraphy : Part 1.—J. Z. Millar. (*J. Franklin Inst.*, June 1946, Vol. 241, No. 6, pp. 397–413.) Includes a history of the electric telegraph, with brief descriptions of the teleprinter, multiplex, and facsimile equipment, and of carrier telegraphy using f.m. for wire line operation. A general description is given of the projected system of radio-beam telegraphy which will eventually replace all line telegraph facilities and provide channels for relaying television. The experimental equipment at present in use operates at 4 000 Mc/s, and microwave techniques developed in the last few years are incorporated. Propagation tests in four frequency bands are also being carried out.

621.396.13 : 621.396.97 **3049**

Multiplex Broadcasting.—D. D. Grieg. (*Elect. Comm.*, March 1946, Vol. 23, No. 1, pp. 19–26.) Proposals for broadcasting multiple programmes over the widest area by means of a u.h.f. relay network using a multiplex system. The system offers great economy of relay equipment. Methods of multiplexing are reviewed, and pulse-time methods are shown to be preferable.

621.396.6.029.58 **3050**

Practical Break-In Operation.—W. H. Allen. (*R.S.G.B. Bull.*, July 1946, Vol. 22, No. 1, pp. 7–9.) Intervals in transmission may be used for replies or repetition requests from the receiving end. Practical requirements and circuits are described.

621.396.61.029.64 **3051**

Our Best DX — 800 Feet !—A. H. Sharbaugh & R. L. Watters. (*QST*, Aug, 1946, Vol. 30, No. 8, pp. 19–22, 24.) Description of apparatus used to obtain two-way telephone communication over a range of 800 ft at a frequency of 21 900 Mc/s. Transmitter and receiver used the same oscillator, a General Electric Z-668 reflex velocity-modulated tube. The power radiated was less than 10 mW.

621.396.619.018.41 **3052**

Frequency Modulation.—T. J. Weijers. (*Philips tech. Rev.*, Feb. 1946, Vol. 8, No. 2, pp. 42–50.) General description of methods of modulating r.f. waves, with a detailed treatment of frequency modulation. The main characteristics necessary for f.m. transmitters and receivers are discussed, and a section is added on non-quasi-stationary phenomena in networks.

621.396.619.16 **3053**

Pulse-Time Modulation.—J. Zwislocki-Moscicki. (*Electronic Industr.*, July 1946, Vol. 5, No. 7, p. 80.) Illustrated summary of a paper in *Bull. schweiz. elektrotech. Ver.*, 25th July & 22nd Aug. 1945, Nos. 15 & 17. A frequency-modulated beat note of about 50 kc/s is obtained between a steady oscillation and a frequency-modulated oscillation of about 1 Mc/s. The beat signal is formed into pulses and used to key a high-frequency (in this case 30-Mc/s) transmitter. In the receiver, the pulses control the frequency of a dynatron square-wave generator from which a signal is passed to a discriminator. Calculations of the effect of a disturbing signal are given in the original paper.

621.396.619.16 **3054**

Pulse Modulation.—E. Fitch : E. R. Kretzmer. (*Wireless Engr*, Aug. 1946, Vol. 23, No. 275, pp. 231–233.) Two letters discussing 183 of January (Roberts & Simmonds) and 1676 of June (Shepherd). Formulae more exact than those given in 183 are deduced for phase-modulated and duration-modulated pulses. See also 2707 of September (Roberts & Simmonds).

621.396.712.004.5 **3055**

Preventive Maintenance for Broadcast Stations : Part 2.—C. H. Singer. (*Communications*, July 1946, Vol. 26, No. 7, pp. 28 . . 55.) Discussion of the purpose, handling, and packing of maintenance tools, including wrenches, drills, etc. For part 1 see 2709 of September. To be continued.

621.397 + 534.862 **3056**

S.M.P.E. [Society of Motion Picture Engineers] **Spring Technical Conference** [New York, May 1946].—(*See* 3087.)

629.135 : 621.396.82 : 551.57 **3057**

Flight Research on Precipitation Static.—Cleveland. (*See* 3038.)

SUBSIDIARY APPARATUS

537.531 **3058**

A Simple X-Ray Spectrometer.—R. S. Rivlin & H. P. Rooksby. (*J. sci. Instrum.*, July 1946, Vol. 23, No. 7, pp. 148–150.) Built of Meccano parts and sufficiently accurate for the determination of crystal axes.

551.57 : 518.3 **3059**

Measurement of Atmospheric Humidity.—E. C. Woods. (*Distrib. Elect.*, July 1946, Vol. 19, No. 163, pp. 152–153.) A nomogram for the direct indication of relative humidity from wet and dry bulb temperatures.

621–712 **3060**

Low Temperatures at Low Cost.—H. N. Brown. (*J. Franklin Inst.*, Dec. 1945, Vol. 240, No. 6, pp. 487–495.) Design details of a temperature test chamber for small electronic components. Preheated to 100° C, it is cooled steadily at 2/3° C/min to −60° C by gases circulated over solid carbon dioxide. Means of controlling the cooling rate are described, and introduction of moisture is guarded against. Other applications of the equipment should be possible.

621.3.066.6 : 629.1–272 **3061**

Electrical Contact Springs.—(*J. Instn elect. Engrs*, Part III, July 1946, Vol. 93, No. 24, p. 242.) Discussion before the I.E.E., opened by L. B. Hunt and H. G. Taylor. For previous accounts see 2786 and 2787 of 1945.

621.314.2.017 **3062**

Thermal Characteristics of Transformers : Part 2.—V. M. Montsinger. (*Gen. elect. Rev.*, May 1946, Vol. 49, No. 5, pp. 31–40.) Methods of calculating temperature rise in windings and in cooling media are applied to transformer problems. The effects of shape and surface colour and of wind and altitude on heat dissipation are discussed. For part 1 see 2015 of July. To be continued.

621.314.2.029.5 : 621.396.619.018.41 **3063**

The Theory and Design of Intermediate-Frequency Transformers for Frequency-Modulated Signals.—Ross. (*See* 2831.)

621.314.5 **3064**

Exciter-Regulator for Aircraft Alternators.—P. T. Hadley, A. W. Forsberg & O. Krauer. (*Electronics*, July 1946, Vol. 19, No. 7, pp. 120–122.) A description of a system of self-excitation of an alternating-current generator using an electronic exciter controlled by a voltage regulator. Circuit diagrams and performance are given for two equipments, a 3-phase constant-frequency main supply, and a single-phase variable-frequency auxiliary supply.

621.314.632.029.62 : [546.28 + 546.289 **3065**

Crystal Rectifiers.—Stephens. (*See* 3108.)

621.315.21.029.4/.6] : 536.4 **3066**

The Power Rating (Thermal) of Radio-Frequency Cables.—R. C. Mildner. (*J. Instn elect. Engrs*, Part III, July 1946, Vol. 93, No. 24, pp. 296–304.) " The principles used in calculating the temperature rise in cables which are required to transmit radio-frequency power are considered. The theoretical attenuation characteristics and power ratings of a number of standard r.f. cables are set down in graphical form for a wide range of operating frequencies. The ratings are based on a maximum temperature rise of 30° C in an ambient of 55°C, established in a matched line for the steady-state condition. The use of suitable " rating factors " for other operating conditions is proposed. The effect of such operating conditions as the presence of standing waves and the effect of end cooling are briefly considered in relation to the rating of the cables."

621.315.668.2 **3067**

Steel Towers for Transmission Lines.—P. J. Ryle. (*Nature, Lond.*, 29th June 1946, Vol. 157, No. 4000, p. 881.) Formula for above-ground weight in terms of overall height and overturning moment. Summary of an I.E.E. paper.

621.316.578.1 **3068**

Variable Timing up to Thirty Seconds.—D. G. Haines. (*Electronics*, July 1946, Vol. 19, No. 7, pp. 154 . . 158.) Short description, with circuit diagram, of an equipment primarily for controlling photographic exposures. Minimum time 0.5 sec.

621.316.722.078.3 **3069**

Voltage Stabilization.—W. Easton. (*Elect. Rev., Lond.*, 28th June 1946, Vol. 138, No. 3579, pp. 1013–1015.) A stabilizer is described giving a stability of better than 1 in 1 000 when connected to a 440-V 3-phase d.c. supply subject to a 12% variation of voltage.

621.316.74 : 621.396.611.21 **3070**

Oven for Airborne Piezoelectric Crystals.—S. Eaton. (*Elect. Comm.*, March 1946, Vol. 23, No. 1, p. 41.) A small unit on a standard 11-pin base for maintaining crystals at a temperature of 75 ±1°C over the range of ambient temperature −40° to +70°C, with a variation of less than 0.3°C for a constant ambient temperature.

621.317 **3071**

Exhibition of British Scientific Instruments in Sweden.—(*J. sci. Instrum.*, July 1946, Vol. 23, No. 7, pp. 137–138.)

621.317.755 : 578.088.7 **3072**

Double-Beam C.R. Tube in Biological Research.—T. H. Bullock. (*Electronics*, July 1946, Vol. 19, No. 7, pp. 103–105.) Instructions for modifying the DuMont 247 oscilloscope to take the 5SP double-beam tube, with an account of some of the resulting facilities.

621.317.755.087.5 : 620.172.222 **3073**

A Six-Channel Electronic Recorder.—M. Scott. (*Electronic Engng*, Aug. 1946, Vol. 18, No. 222, pp. 233–235, 261.) Description of a 6-c.r.-tube oscillograph giving simultaneous records photographed by a single camera unit on 120-mm paper moving at 0.5 to 1 000 inch/sec. Each tube has an a.c./d.c. amplifier (0–10 kc/s), monitor tube, and a calibration and time-marking unit controlled by a 1-kc/s fork oscillator. Primarily designed for strain-gauge bridge measurements ; built-in balancing units allow 48 channels to be switched in batches of 6 without rebalancing the bridge.

621.385.833 **3074**

Electron Microscope of the State Optical Institute.—V. N. Vertzner. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 5, pp. 232–234. In Russian.) Description of the microscope and its lenses, with examples of the magnification produced. See also 2302 of 1945. English summary noted in 1948 of July.

621.386.1 **3075**

X-Ray Tubes with Rotating Anode (" Rotalix " Tubes).—J. A. van der Tuuk. (*Philips tech. Rev.*, Feb. 1946, Vol. 8, No. 2, pp. 33–41.) The latest tubes are described, and various problems connected with the rotating anode are discussed.

621.395.625.6 : 621.383 **3076**

A Phototube for Dye Image [colour film] **Sound Track.**—A. M. Glover & A. R. Moore. (*J. Soc. Mot. Pict. Engrs,* May 1946, Vol. 46, No. 5, pp. 379–386.)

621.395.625.6 : 621.383 **3077**

Behavior of a New Blue-Sensitive Phototube [for black-and-white or colour film tracks] **in Theater Sound Equipment.**—Phyfe. (*See* 2806.)

621.396.62 + 621.317.35 **3078**

Alarm System for Panoramic Receivers.—W. A. Anderson. (*Electronics,* July 1946, Vol. 19, No. 7, pp. 92–95.) A motor-driven commutator divides each sweep period of the panoramic display into 40 equal parts and supplies a direct voltage with an independently controlled amplitude during each part. The output from this device is added to the receiver output and adjusted to cancel the cathode-ray deflexions produced by the received signals. Deflexions produced by reception of a new signal or by drift of the frequency of a signal previously neutralized triggers an alarm circuit. Other applications of the device (*e.g.* for coded transmission and network analysis) are mentioned.

621.396.682.029.4/.6 **3079**

R.F. Power Supplies.—M. Rhita. (*Radio Craft,* June 1946, Vol. 17, No. 9, pp. 616..647.) A 300-kc/s oscillator with an air-cored transformer and rectifier produces 10 kV for c.r.t. operation.

771.35 **3080**

A Classification of Photographic Lens Types.—R. Kingslake. (*J. opt. Soc. Amer.,* May 1946, Vol. 36, No. 5, pp. 251–255.) The classification, based on the number of components in the lens, has been used in the Eastman Kodak Company for several years.

539.16.08 + 621.318.572 **3081**

Electron and Nuclear Counters. [Book Review]—S. A. Korff. D. Van Nostrand, New York, 212 pp., $3.00. (*Electronic Industr.,* July 1946, Vol. 5, No. 7, p. 112.) Deals with the action and construction of counter tubes and auxiliary electronic circuits. ". . . an extensive and scholarly summary. . . ."

621.327.3/.4 **3082**

Electric Discharge Lamps. [Book Review]—H. Cotton. Chapman & Hall, London, 435 pp., 216 figs., 36s. (*Elect. Rev., Lond.,* 5th July, 1946, Vol. 139, No. 3580, p. 26.) ". . . gives a most valuable account of the whole subject. . . ."

TELEVISION AND PHOTOTELEGRAPHY

621.32 : 621.397.5 **3083**

An Appraisal of Illuminants for Television Studio Lighting.—R. E. Farnham. (*J. Soc. Mot. Pict. Engrs,* June 1946, Vol. 46, No. 6, pp. 431–440.) Discussion of required spectral sensitivity and illumination levels, and description of suitable sources.

621.325 : 621.397.5 **3084**

Carbon Arcs for Motion Picture and Television Studio Lighting.—F. T. Bowditch, M. R. Null & R. J. Zavesky. (*J. Soc. Mot. Pict. Engrs,* June 1946, Vol. 46, No. 6, pp. 441–453.) Discussion of photometric and spectral energy distribution of carbon arc sources and their future use in television.

621.383.8 **3085**

The Image Orthicon — A Sensitive Television Pickup Tube.—A. Rose, P. K. Weimer & H. B. Law. (*Proc. Inst. Radio Engrs, W. & E.,* July 1946, Vol. 34, No. 7, pp. 424–432.) A detailed account of the tube described more briefly in 1376 of May. For application see 2374 of August (Kell & Sziklai).

621.396.615.17 : 621.397.645 **3086**

Electromagnetic Deflection : Television Line Scanning Amplifier.—W. T. Cocking. (*Wireless World,* July 1946, Vol. 52, No. 7, pp. 217–222.) Discussion of circuit technique using a pentode or tetrode valve transformer-coupled to the deflector coil in a television line-scanning amplifier. Detailed analysis is given of the equivalent circuit of a typical amplifier. A linear scan may be obtained, using standard silicon-steel transformer cores, from a saw-toothed input which is rounded at the beginning and end of the fly-back, thus eliminating very high component frequencies. It is generally assumed that the circuit should be critically damped to avoid oscillations causing nonlinearity at the start of the scan, but by slightly underdamping, the effective capacitance across the primary circuit can be charged, by the overswing, to the correct value to suit the start of the scan. Details of a practical circuit and its adjustment for correct operation are given.

621.397 + 534.862 **3087**

S.M.P.E. [Society of Motion Picture Engineers] **Spring Technical Conference** [New York, May 1946]. —(*Electronics,* July 1946, Vol. 19, No. 7, pp. 188..198.) An account of the proceedings, including abstracts of the following papers : Modernization Desired in Studio Equipment, by L. L. Ryder ; Theater Television, by L. B. Isaac ; Unified Approach to Film [television] Pickup Tubes, and the Eye, by A. Rose ; Color Television, by P. C. Goldmark ; Factors Governing Frequency Response [in film sound recording], by M. Rettinger & K. Singer ; Theater Servicing Test Equipment, by E. Stanko & P. V. Smith.

621.397 : 621.396.931 **3088**

Facsimile to Moving Train *via* V.H.F.—(*Electronics,* July 1946, Vol. 19, No. 7, pp. 168..178.) General description, with block diagrams.

621.397.26 **3089**

The B.B.C. Television Waveform.—(*J. Televis. Soc.,* Dec. 1945, Vol. 4, No. 8, p. 196.) See also 2368 of August.

621.397.26 **3090**

Strato-Television.—C. E. Nobles. (*J. Televis. Soc.,* Dec. 1945, Vol. 4, No. 8, pp. 200–203.) An account of the Westinghouse proposals. See also 3970 of 1945 and 2370 of August.

621.397.26 **3091**

A Method of Transmitting Sound on the Vision Carrier of a Television System.—D. I. Lawson, A. V. Lord & S. R. Kharbanda. (*J. Instn elect. Engrs,* Part III, July 1946, Vol. 93, No. 24, pp. 251–274.) "The paper describes a television system in which sound pulses having a constant height and variable width are inserted in the line synchronizing periods. It is claimed that this method of transmission leads to a simplified receiver, and that the programme quality is better in the presence of severe interference. Other advantages are that the frequency bandwidth for transmission is reduced; the method of receiving sound ensures automatic volume control; the sound pulses provide a fixed reference level for automatic volume control on the vision channel; mutual interference between vision and sound often present on two-channel reception is avoided; reduced transmission bandwidth simplifies the design of the receiving antenna; mutual coupling between the vision and sound antennae at the transmitter is avoided; and the installation and maintenance costs of the sound transmitter are saved.

"The frequency range of the system operated in conjunction with the pre-war British transmission would be limited to 5 kc/s."

For earlier less detailed accounts of the system see 459 of February and back references. See also 1382 of May (Fredendall, Schlesinger & Schroeder).

621.397.5 **3092**

Studio Technique in Television.—D. C. Birkinshaw & D. R. Campbell. (*J. Instn elect. Engrs*, Part III, July 1946, Vol. 93, No. 24, pp. 293–294.) Discussion of I.E.E. paper. See 3961 of 1945 and 781 of March.

621.397.5 **3093**

Informal Meeting [of the Television Society] **and Exhibition.**—(*J. Televis. Soc.*, Dec. 1945, Vol. 4, No. 8, pp. 197–199.) Descriptions of some of the items exhibited.

621.397.6 : 621.396.67 **3094**

C.B.S. Tele Antenna.—Sather. (*See* 2826.)

621.397.62 : 621.317.79 **3095**

A Television Signal Generator: Part 3—R.F. Circuits and Monitors.—Hibberd. (*See* 2980.)

621.397.64 **3096**

[Frequency compensation in] **Video Amplification.**—J. McQuay. (*Radio Craft*, June 1946, Vol. 17, No. 9, pp. 613..655.)

621.397.823 **3097**

Tele[vision] **Interference: Parts 1 & 2.**—T. T. Goldsmith. (*Electronic Industr.*, July & Aug. 1946, Vol. 5, Nos. 7 & 8, pp. 60–61, 108 & 73–75..96.) A general analysis of signal sources which may affect both picture and sound reception quality, with (part 2) specific recommendations for engineering changes that can be made to effect improvement.

TRANSMISSION

621.396.61/.62 **3098**

"Portarig" Ham Station.—R. F. Scott. (*Radio Craft*, June 1946, Vol. 17, No. 9, pp. 611..650.) A transmitter-receiver with crystal control for mains or 6-V battery operation.

621.396.61 **3099**

Frequency Meters as Master Oscillators.—E. H. Conklin. (*QST*, Aug. 1946, Vol. 30, No. 8, pp. 34..132.) Description of an amplifier for boosting the output of a frequency meter (U.S. Service type) so that it may be used to control the frequency of a transmitter. The accuracy of frequency control was found to be about 100 cycles per megacycle under severe changes of temperature and humidity.

621.396.61/.62].029.5 : 629.135 **3100**

A General-Purpose Radio-Communication Equipment for Military Aircraft.—Honnor & Blom. (*See* 3023.)

621.396.61.029.5 : 629.135 **3101**

A Communication Transmitter for Civil Aircraft.—J. G. Downes. (*A.W.A. tech. Rev.*, March 1946, Vol. 6, No. 8, pp. 473–488.) The oscillator uses crystals for 2.5 to 13 Mc/s and tuned circuits for 300 to 510 kc/s. It drives a power amplifier (output 40 W) which is anode-modulated by an audio amplifier to provide telephony, c.w. telegraphy, and modulated c.w. telegraphy. Frequency selection is accomplished by means of a turret switch driven by an electric motor through gearing and a geneva movement.

621.396.615 **3102**

Raising the Efficiency of the V.H.F. Linear Oscillator.—G. D. Perkins & H. G. Burnett. (*QST*, Aug. 1946, Vol. 30, No. 8, pp. 48–52.) A description of practical details for the frequency range 140–250 Mc/s.

621.396.615 : 621.396.662 **3103**

Permeability-Tuned Oscillators.—T. A. Hunter. (*QST*, Aug. 1946, Vol. 30, No. 8, pp. 42–46.) A comparison between variable permeability- and capacitance-tuned oscillators shows (*a*) the range of permeability tuning is restricted to about 3 : 1 compared with 4 : 1 for capacitance tuning; (*b*) less frequency drift occurs with permeability-tuned oscillators during warming-up time, as the total tuning capacitance may be made larger than for capacitance-tuned oscillators with the same frequency range; (*c*) temperature compensation may be applied to both types of oscillator; (*d*) the permeability-tuned oscillator is superior to the other in frequency stability when subjected to mechanical vibration.

621.396.619.018.41 **3104**

F.M. Carrier Stabilization: Part 2—Western Electric, Westinghouse, R.C.A. Circuits.—I. Queen. (*Radio Craft*, June 1946, Vol. 17, No. 9, pp. 605..637.) For part 1 see 2765 of September.

621.396.619.018.41 : 621.396.66 **3105**

Direct F.M. Frequency-Control Methods.—N. Marchand. (*Communications*, July 1946, Vol. 26, No. 7, pp. 30–35.) Discussion of three methods for stabilizing the centre frequency of an f.m. transmitter which uses a direct system of modulation. Basic circuits for each of the methods are presented and analysed. Part 7 of a series. For previous parts, see 2767 of September and back references.

621.396.712 **3106**

Canada's New Short Wave Transmitters.—H. B. Seabrook & F. R. Quance. (*Electronic Industr.*, July 1946, Vol. 5, No. 7, pp. 72–74..105.) Engineering details. See also 193 of January (Smith) and 744 of March (Cahoon).

VALVES AND THERMIONICS

621.3.032.216 : 537.533.8 **3107**

Secondary Electron Emission from Oxide-Coated Cathodes: Part 1.—M. A. Pomerantz. (*J. Franklin Inst.*, June 1946, Vol. 241, No. 6, pp. 415–433.)

An investigation of factors affecting the yield of secondary electrons under both continuous and pulsed bombardment. The variations of yield and energy distribution with primary voltage and with temperature have been determined, and these and other phenomena are discussed in the light of the present state of the theory.

621.314.632.029.62 : [546.28 + 546.289 **3108**

Crystal Rectifiers.—W. E. Stephens. (*Electronics*, July 1946, Vol. 19, No. 7, pp. 112–119.) A description of the mechanical construction and performance of germanium and silicon rectifiers developed for frequency conversion and signal detection at microwavelengths. The preparation and electrical properties of the materials are described. Noise, stability, and the dependence of the properties on temperature are considered, and properties of 22 types of rectifier with assigned type-numbers are tabulated. See also 1728 of June (Cornelius).

621.385 **3109**

Total Emission Damping with Space-Charge-Limited Cathodes.—C. N. Smyth. (*Nature, Lond.*, 22nd June 1946, Vol. 157, No. 3999, p. 841.) Electrical damping at very high radio frequencies may be due to emission from the cathode surface which returned to the cathode after a time comparable with the h.f. period. The effect could be reduced by cooling the cathode, and was not detectable at low frequencies. Such damping behaves as a source of noise with the general characteristics of ' shot ' noise.

621.385 **3110**

Valve Standardization.—J. W. Ridgeway. (*Wireless World*, July 1946, Vol. 52, No. 7, pp. 239–240.) Report by the Chairman of the British Valve Manufacturers' Association, on progress towards the manufacture of valves having standard working characteristics.

621.385 : 003.6 **3111**

Suggested Rules for Symbols in Valve Nomenclature.—(*Electronic Engng*, Aug. 1946, Vol. 18, No. 222, p. 254.) Extracts from rules proposed by the British Valve Manufacturers' Association for use in technical literature issued by its members.

621.385.1 **3112**

The Effect of Grid-Support Wires on Focusing Cathode Emission.—Chai Yeh. (*Proc. Inst. Radio Engrs, W. & E.*, July 1946, Vol. 34, No. 7, pp. 444–447.) A conformal transformation is applied to a half section of a valve system consisting only of anode and cathode, with grid-support wires. Those parts of the cathode that have a positive field adjacent due to electrostatic charges on the electrodes are thereby determined, enabling the angle of electron emission to be found. Curves show the variation of this angle with anode and grid potentials and with electrode dimensions and spacings.

621.385.16 **3113**

The Magnetron.—W. E. Willshaw & E. C. S. Megaw. (*Engineering, Lond.*, 19th April 1946, Vol. 161, No. 4188, pp. 361–363.) Illustrated general description.

621.385.16.029.64 **3114**

Rising Sun Pulsed and C.W. Magnetrons.—H. G. Shea. (*Electronic Industr.*, Aug. 1946, Vol. 5, No. 8, pp. 46–50.) The construction and performance of cavity magnetrons with alternate small and large cavities are described. Oscillations in unwanted modes are suppressed with more efficient operation than is obtained with the strapped-anode technique. Other advantages are (*a*) larger and simpler structure for a given small wavelength (*e.g.* 6 mm), (*b*) mode separation independent of anode-block thickness, (*c*) mode separation persists for a relatively large number of cavities (*e.g.* 38), (*d*) copper losses are less than with strapped anodes. An important disadvantage is zero-mode contamination of the wanted π mode for magnetic fields near 12 000/λ oersted. A c.w. magnetron with a tungsten-coil cathode gave 900 W with 26% efficiency at 2.6 cm wavelength.

621.385.3/.4].029.62 **3115**

High Power Tubes for V.H.F. Operation.—W. W. Salisbury. (*Communications*, June 1946, Vol. 26, No. 6, pp. 33, 49.) Survey of triodes and tetrodes giving powers above 1 kW usable at frequencies between 100 and 220 Mc/s.

621.385.3.029.63 : 621.397.61 **3116**

High-Power U.H.F. Tube.—(*Radio Craft*, June 1946, Vol. 17, No. 9, pp. 608..640.) The 6C22 valve, anode dissipation 2 kW, and its use in the Columbia 490-Mc/s colour television transmitter.

621.385.38 : 621.396.619.16 **3117**

Hydrogen Thyratrons.—H. Heins. (*Electronics*, July 1946, Vol. 19, No. 7, pp. 96–102.) A description of the 4C35 and 5C22 tubes developed for use with high-voltage line pulse-forming circuits used for modulating magnetrons. Hydrogen filling gives the required low de-ionization time. The special construction and properties are discussed in relation to the mechanism of the modulator circuits. Switching rates up to 5 000 per sec have been obtained with the 5C22 with 8 kV and 75 A peak current, and rates over 100 000 per sec have been obtained with the 4C35 at lower voltages and currents. Possible industrial applications are mentioned.

621.385.4 **3118**

Space Charge and Electron Deflections in Beam Tetrode Theory.—S. Rodda. (*J. Televis. Soc.*, Dec. 1945, Vol. 4, No. 8, pp. 182–193. Discussion, pp. 193–195.) Secondary emission from the anode is annulled in beam tetrodes by a sufficient depression of potential in the screen/anode space, produced either by the space charge alone or with the aid of auxiliary electrodes. The potential distribution in the space is calculated by extending Gill's analysis for a plane parallel system (*Phil. Mag.*, 1925, Vol. 49, pp. 993–1005.) The critical current condition in which a virtual cathode is formed is found to give " knee " voltages (anode voltages at which the characteristic abruptly flattens) much higher than the observed values. The assumptions of transverse deflexions of the electrons at the grid and screen wires and of reflection at a finite non-zero potential lead to results in fair agreement with experiment.

621.385.4 **3119**

Beam Tetrodes.—S. Rodda. (*Wireless Engr*, July 1946, Vol. 23, No. 274, pp. 202–203.) Assuming copious emission of secondary electrons with zero velocity, it is shown that the space charge due to the secondary electrons plays an important part in producing a potential minimum in the screen/anode space, when the primary electron flow itself is insufficient for the formation of the minimum. Brief note only.

621.385.4 **3120**

The 6AR6 Tube.—E. A. Veazie. (*Bell Lab. Rec.*, July 1946, Vol. 24, No. 7, pp. 264–265.) Short description of the design and performance of a small beam-tetrode that can operate with 20 W anode dissipation and 1 300 V anode voltage.

621.385.5 : 621.395.645 **3121**

Dynamic Characteristics of Pentodes.—Haefner. (*See* 2846.)

621.385.5 : 621.395.645 **3122**

Reentrant Pentode A.F. Amplifier.—R. Adler. (*Electronics*, June 1946, Vol. 19, No. 6, pp. 123–125.) A special pentode operating as two triodes in cascade giving gains up to 500 with a 45-V plate supply. Control of regeneration, and design precautions to be observed are discussed. The second grid forms the anode of the first triode, and the third grid and plate form the second triode.

621.385.832 **3123**

The 5RP Multiband Tube: An Intensifier-Type Cathode-Ray Tube for High-Voltage Operation.—I. E. Lempert & R. Feldt. (*Proc. Inst. Radio Engrs, W. & E.*, July 1946, Vol. 34, No. 7, pp. 432–440.) The performance at frequencies up to 100 Mc/s is improved by increasing the trace intensity by means of several cylindrical intensifying electrodes introduced into the region between the deflecting plates and screen. The distortions caused by an excessive ratio of intensifier potential to second-anode potential are illustrated, and the design to enable a ratio of 10 : 1 to be used is described. Applications to high-speed transient recording and projection are suggested, and the extension of the frequency range to 1 000 Mc/s using coaxial connexions to the deflecting plates is proposed.

621.385.832.032.2 **3124**

The Electron Gun of the Cathode Ray Tube: Part 2.—H. Moss. (*J. Brit. Instn Radio Engrs*, June 1946, Vol. 6, No. 3, pp. 99–129.) Conclusion of 3534 of 1945. An extended practical treatment is given of the factors entering into the design of the triode portion of the tube, in which its characteristics are related to the electrode voltages and geometry. The results of this section are summarized in tabular form. Relevant data are given for a number of c.r. tubes in general use, for which the smallness of the useful cathode area "demonstrates how vital is the fine structure of the emitting cathode surface". Discussion included.

621.386.1 **3125**

X-Ray Tubes with Rotating Anode ("Rotalix" Tubes).—van der Tuuk. (*See* 3075.)

621.396.822 : 621.385.2 **3126**

'Shot-Effect' in Diodes Under Retarding Field Conditions.—R. Fürth & D. K. C. MacDonald. (*Nature, Lond.*, 22nd June 1946, Vol. 157, No. 3999, p. 841.) Experiments were carried out with a number of close-spaced diodes over a wide range of current up to a limiting current I_c, and shot effect was measured as under saturated conditions. A discrepancy of up to 10 : 1 was found between the theoretical and practical values of I_c. This can be explained by the existence of a potential barrier at the anode surface which would prevent slower electrons from penetrating into the anode.

621.396.822 : 621.385.3 **3127**

Fluctuations in Electrometer Triode Circuits.—van der Ziel. (*See* 2833.)

MISCELLANEOUS

001.89 **3128**

Organization of Scientific and Industrial Research.—(*Nature, Lond.*, 4th May 1946, Vol. 157, No. 3992, pp. 565–568.) An editorial discussion of recent proposals for organization on a national scale, with particular reference to the Bush report (see 492 of February) and the discussion of it by other authorities.

001.89 (410) **3129**

Scientific and Industrial Research in Great Britain.—(*Nature, Lond.*, 1st June 1946, Vol. 157, No. 3996, pp. 709–712.) An editorial account of the scope, responsibilities, and activities of the Department of Scientific and Industrial Research, and future trends in its research programme.

001.89 (410) **3130**

[Scale of grants to workers and students for] **Scientific and Industrial Research in Great Britain.**—O. F. Brown. (*Nature, Lond.*, 29th June 1946, Vol. 157, No. 4000, p. 879.)

001.89 : 6 **3131**

Industry and Research.—(*Engineer, Lond.*, 5th April 1946, Vol. 181, No. 4708, pp. 312–314, and *Nature, Lond.*, 25th May 1946, Vol. 157, No. 3995, pp. 684–686.) An account of a conference under the auspices of the Federation of British Industries. The main speeches and discussion covered education and research in large and small firms and in government laboratories.

001.891 : 629.13 **3132**

Aviation and Scientific Research.—M. Griaule. (*Nature, Lond.*, 22nd June 1946, Vol. 157, No. 3999, pp. 848–849.) Section formed under the auspices of the Congrès de l'Aviation Française. Research investigations using aircraft may be classed under the three headings: stratosphere, atmosphere, and earth's surface.

001.891 : 8–96 **3133**

Rationalization of the Literature of Scientific Research.—(*Nature, Lond.*, 8th June 1946, Vol. 157, No. 3997, pp. 745–748.) The necessity for an organization to deal with scientific literature.

061.5 : 621.317.2.027.8 **3134**

The New Brown Boveri High-Tension Testing Laboratory.—W. Wanger. (*Brown Boveri Rev.*, Sept./Oct. 1943, Vol. 30, Nos. 9/10, pp. 212–217.) **The Installations of the New Brown Boveri High-Tension Testing Laboratory.** — F. Beldi & C. Degoumois. (*Same journal*, pp. 218–221.) Abstracts in *Rev. gén. Élect.*, Jan. 1946, Vol. 55, No. 1, p. 1D.

061.5 : 621.381.39 **3135**

War Years' Review: Part 1.—(*Elect. Comm.*, March 1946, Vol. 23, No. 1, pp. 3–18.) A survey of the wartime activities of Standard Telephones & Cables, Ltd., London and Sydney. The first of a series describing the wartime work of the I.T. & T. associates.

061.5 : 621.39 **3136**

Telecommunications Research.—(*Electrician*, 7th June 1946, Vol. 136, No. 3549, p. 1513.) Brief report of the achievements of the Marconi's Wireless

Telegraph Co. in high-speed communications and ionospheric work.

061.6 **3137**
The National Physical Laboratory.—(*Engineer, Lond.*, 28th June 1946, Vol. 181, No. 4720, pp. 590–591.) An account of the first post-war annual exhibition of work in progress.

061.6 : 621.3.027.3 **3138**
The Parsons Memorial Lecture : " High-Voltage Research at the National Physical Laboratory ".—R. Davis. (*J. Instn elect. Engrs*, Part I, April 1946, Vol. 93, No. 64, pp. 177–186.) An account of the methods of producing and measuring high d.c., power-frequency, and surge voltages, and the application to the protection of high-voltage transmission lines and barrage balloons. See also 2415 of August.

347.771 **3139**
Patent Law Proposals.—(*Engineer, Lond.*, 7th June 1946, Vol. 181, No. 4717, pp. 513–515.) Recommendations of changes to improve the British Patents and Designs Acts.

5 + 6] : 621.396.97 **3140**
Science and Radio.—(*Nature, Lond.*, 8th June 1946, Vol. 157, No. 3997, pp. 757–758.) A conference to consider the contribution of the B.B.C. to the promotion of scientific knowledge.

5 + 6] [(437) + (436.9) **3141**
Science in Czechoslovakia and Yugoslavia.—(*Nature, Lond.*, 13th April 1946, Vol. 157, No. 3989, p. 487.)

534.1 **3142**
Some Notes on Vibration Analysis.—R. J. Manley. (*J. roy. aeron. Soc.*, July 1945, Vol. 49, No. 415, pp. 419–426.) An outline of the fundamental process of solving vibration problems by applying Lagrange's equation to a system of idealized inertia, spring, and dissipative elements made to represent the actual system. The analysis includes an account of the concepts of natural modes, equilibrium amplitudes, and dynamic magnifiers.

551.5 : 629.135 : 621.396.6 **3143**
The Effects of Atmospheric Conditions on Aircraft Radio Equipment.—W. W. Honnor. (*A.W.A. tech. Rev.*, March 1946, Vol. 6, No. 8, pp. 529–551.) Describes laboratory test chambers for simulating the ranges of temperature, pressure, and humidity likely to occur. D.c. flash-over voltages of cable connectors are given for saturated air at 35 000 feet and corona voltages at 300 kc/s are given for a large number of materials. A circuit is described for the measurement of flash-over voltages of sphere-gaps at 2.5 Mc/s and 19 Mc/s, and curves show the variation of spark-over voltage with altitude for spacings of 0.05 inch to 0.50 inch. Results are also given for spark-over voltages of variable capacitors, including a wire close to a conducting plane, in air at a pressure of 7 inches of mercury for frequencies up to 20 Mc/s.

6(07) **3144**
Science and Education.—E. G. Carter. (*Nature, Lond.*, 16th March 1946, Vol. 157, No. 3985, pp. 344–345.) An account of a conference of the Association of Scientific Workers.

62.004.11 **3145**
Preparation and Use of Specifications.—G. Reinsmith. (*ASTM Bull.*, March 1946, No. 139, pp. 41–44.)

62.004.11 : 519.283 **3146**
Use of Statistics in Writing Specifications.—C. Goffman & J. Manuele. (*ASTM Bull.*, March 1946, No. 139, pp. 13–17.)

62.004.11 : 519.283 **3147**
Dollars for Your Thoughts.—L. E. Simon. (*ASTM Bull.*, March 1946, No. 139, pp. 17–21.) An account of the advantage of framing specifications on the basis of statistical methods and quality control carefully designed to produce the required result.

621.3.025 **3148**
Demonstration Devices.—W. K. Allan. (*Radio Craft*, May 1946, Vol. 17, No. 8, pp. 532..571.) Description of mechanical and electrical devices for demonstrating alternating current and voltage relationships in circuits.

621.315.1.056.1 **3149**
Tensions in Hanging Wires.—Hookham. (*See* 2808.)

621.38/.39](43) **3150**
German Electronic Equipment.—(*Wireless World*, May 1946, Vol. 52, No. 5, pp. 163–164.) Account of equipment at the Earls Court Exhibition. See also 2438 of August.

621.396(43) **3151**
Communications in Germany.—P. Mertz. (*Bell Lab. Rec.*, July 1946, Vol. 24, No. 7, pp. 271–274.) The Germans had a broad-band cable network for multi-carrier telephone and television between the principal cities ; wired wireless was extensively used. In the television field, large-screen projectors with definition up to 1 000 lines were envisaged. Much work was being done on photo-sensitive materials.

621.396.611 **3152**
A Mechanical Model Analogous to an Oscillatory Electrical Circuit.—G. G. Blake. (*Engineer, Lond.*, 14th June 1946, Vol. 181, No. 4718, pp. 535–536.) The model can be used to show variations in the *Q* of an oscillatory circuit or to illustrate resonance between an oscillator and a second tuned circuit.

621.396.621.003.1(4) **3153**
Report on European Radio Industry.—L. Laden. (*Radio News*, May 1946, Vol. 35, No. 5, pp. 25.. 114.) Report on the European demand for domestic radio and television receivers, and the capability of the American radio industry to supply them.

001.89 **3154**
[British] **Industrial Research and Development.** [Book Review]—F. Heath & A. L. Hetherington. Faber & Faber, London, 1946, 25s. (*Engineer, Lond.*, 24th May 1946, Vol. 181, No. 4715, pp. 477–478.) A very favourable review.

016 : [621.38/.39 **3155**
The Electronic Engineering Master Index. [Book Review]—F. A. Petraglia (Ed.). Electronics Research Pub. Co., New York, 1945, 317 pp., $17.50. (*Electronics*, May 1946, Vol. 19, No. 5, pp. 324, 326.) See also 2108 of July.

621.396.029.64 **3156**
Understanding Microwaves. [Book Review]—V. J. Young. J. F. Rider, New York, 400 pp., $6.00. (*Radio, N.Y.*, May 1946, Vol. 30, No. 5, pp. 45–46.)

ABSTRACTS AND REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534.1 **3157**

Approximate Methods for the Study of Sound Sources.—P. G. Bordoni. (*Alta Frequenza*, Sept./Dec. 1945, Vol. 14, Nos. 3/4, pp. 225–226.) Abstract of a paper in *Acta Pont. Acad. Sci., Vatican City*, 1944, Vol. 8, No. 8, pp. 61–66.

534.121.1 **3158**

The Fundamental Frequency of Vibration of Rectangular Wood and Plywood Plates.—R. F. S. Hearmon. (*Proc. phys. Soc.*, 1st July 1946, Vol. 58, No. 328, p. 487.) Discussion of 1145 of May.

534.13 **3159**

Radiation Characteristics of a Rigid Sphere Having an Oscillating Shell.—P. G. Bordoni. (*Alta Frequenza*, Sept./Dec. 1945, Vol. 14, Nos. 3/4, pp. 226–227.) Abstract of a paper from *Commentationes Pont. Acad. Sci., Vatican City*, 1944, Vol. 8, No. 18, pp. 505–525. The shell subtends an angle of $\pi/2$ at the centre. Analysis shows that the device can (*a*) radiate an acoustic power that remains almost constant with changing frequency provided the radius of the sphere is less than a third of the wavelength; for higher frequencies the power slowly decreases: (*b*) produce along its axis an acoustic pressure increasing with frequency until it amounts to twice its initial value.

534.13 : 621.396.611.1 **3160**

The Equivalent Circuit of a Spherical Vibrator.—G. Sacerdote. (*Alta Frequenza*, March 1946, Vol. 15, No. 1, pp. 28–33.) A theoretical analysis of the specific acoustic impedance of a spherical vibrator of order n. The equivalent circuit consists of a ladder network with series capacitors and shunt inductors (with values in harmonic progression) terminated in a pure resistance.

534.43 : 621.395.613.32 **3161**

Carbon Phonograph Pickup.—A. B. Kaufman & E. N. Kaufman. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 162..168.) A description of the preliminary design of a pickup based on the carbon-microphone principle.

534.844/.845 **3162**

Absorption and Scattering by Sound-Absorbent Cylinders.—R. K. Cook & P. Chrzanowski. (*Bur. Stand. J. Res.*, April 1946, Vol. 36, No. 4, pp. 393–410.) Expressions are developed for a normally incident wave, the surface of the cylinder having an assumed normal acoustic impedance. The theory predicts, and measurements in a reverberation room confirm, that cylinders may have coefficients greater than unity. Reverberation-room statistics are also developed for spherical absorbers.

534.88 **3163**

Echo Depth Sounder for Shallow Water.—G. B. Shaw. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 88–92.) A review of requirements, with a technical description of the Submarine Signal Co. model 788A precision ultrasonic depth recorder suitable for hydrographic surveying. Recording range 75 ft, which can be set to cover any part of a total depth range from 3 ft to 250 ft. Accuracy ± 3 inches up to 50 ft, ± 6 inches for 50–125 ft and 1% for 125–250 ft. Compensating controls are provided for draft, squat, tide, elevation, and sound velocity. Magnetostriction transducers are used at 21.5 kc/s. The transmitter is excited by an unusual capacitor-discharge system. Circuit diagrams of the driver and receiver are given.

534.88 : 534.321.9 **3164**

The "Sonicator".—(*Radio Craft*, Aug. 1946, Vol. 17, No. 11, pp. 752..793.) A horn-type loudspeaker unit at the focus of a parabolic reflector emits sound pulses of 100-μs duration once a second. The echoes are received on a crystal microphone near the focus of the reflector, amplified, and used to operate a neon light revolving once a second behind a transparent disk. The position of the flash on the disk gives the distance of the target, the direction is obtained by rotation of the reflector to give the maximum echo. The range is 550 ft down to 5 ft. An invention by L. Gould.

621.395.61 **3165**

Mechanical Impedance and the Classification of Microphones.—P. G. Bordoni. (*Alta Frequenza*, Sept./Dec. 1945, Vol. 14, Nos. 3/4, pp. 218–224.) The distinction between pressure, gradient, and velocity microphones is indicated in relation to their mechanical characteristics, and, in particular, the effect of the surrounding air on the mechanical impedance of a diaphragm is considered.

621.395.61 **3166**

Meet the Microphone.—H. J. Seitz. (*Radio News*, Aug. 1946, Vol. 36, No. 2, pp. 28..74.) A brief review of the characteristics and special uses of modern microphones of the condenser, crystal, and ribbon types.

621.395.625.3 **3167**

Theoretical Response from a Magnetic-Wire Record.—M. Camras. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1946, Vol. 34, No. 8, pp. 597–602.) " This paper considers the effect of magnetic properties of a record wire on the output level and frequency response of a magnetic recording system. The amount of magnetic energy that can be stored at each wavelength determines the voltage output to be expected from a given translating head. Frequency response for a typical record wire is calculated according to derived relations, and compared with experimental data."

621.395.645.3 **3168**

Cathode Follower for Power Amplifier.—Stevens. (*See* 3206.)

621.396.615.029.3 **3169**

Audio Oscillators.—J. C. Hoadley. (*Radio News*, Aug. 1946, Vol. 36, No. 2, pp. 38–40, 98.) Two types of RC or Wien-bridge oscillators are described, one using variable C and the other variable R for controlling the frequency. Circuit diagrams and constructional details are given.

621.396.667 **3170**

Tone Control Circuits.—L. A. Wortman. (*Radio Craft*, Aug. 1946, Vol. 17, No. 11, pp. 763, 781.) Five simple resistance-capacitance circuits are given.

786.6 : 621.383 **3171**

Photoelectric Tone Generator.—Greenlee. (*See* 3391.)

AERIALS AND TRANSMISSION LINES

621.392 **3172**

Study of the Diffraction and Reflection of Guided Waves.—J. Ortusi. (*Ann. Radioélect.*, Oct. 1945, Vol. 1, No. 2, pp. 87–133.) A theoretical and experimental study of a plane H_{01} wave in a rectangular guide. The introduction defines the coefficients of reflection and transmission and the characteristic impedances. The analogy between a guide carrying a H_{01} wave and a lightly damped transmission line is indicated.

The thermocouple apparatus used for measuring the field intensity in the guide, and the methods of measuring wavelength and the coefficients of reflection at an obstacle in the guide are described.

The impedance and reflection coefficient of a wire across the guide are calculated.

The theoretical treatment of diffraction is based on Kottler's presentation of Huyghens' principle (*Ann. Phys.*, 1923, p. 456). The following cases are analysed: opening in a rectangular guide, sectoral horn, and a cylindrical mirror. Experimental investigation of the diffraction and reflection at the opening of a guide is described, and it is concluded that only for large apertures (a and $b > 2\lambda$) are Kottler's formulae of good accuracy.

The effect of a change of dielectric in a guide is analysed, and its application to the measurement of dielectric constant and damping coefficient is described.

Obstacles in the form of a conducting disk with a small hole, a wire, and a change of curvature of the wave are considered in detail, using the impedance representation in conjunction with reflection and transmission coefficients.

Corrections are given in *Ann. Radioélect.*, Jan. 1946, Vol. 1, No. 3, p. 276.

621.392 **3173**

The Theory and Experimental Behaviour of Right-Angled Junctions in Rectangular-Section Wave Guides.— J. T. Allanson, R. Cooper & T. G. Cowling. **The Experimental Behaviour of the Coaxial Line Stub.**—J. Lamb. (*J. Instn elect. Engrs*, Part I, Aug. 1946, Vol. 93, No. 68, pp. 359–360.) Long summary of 2133 & 2134 of August.

621.392 **3174**

Ideas on Waveguides.—Y. Rocard. (*Rev. tech. Comp. franç. Thomson-Houston*, April 1946, No. 5, pp. 5–19.) An elementary survey of the velocity and field relations in a waveguide, and of the various modes of propagation. Reference is made to filters, mode separators, mode converters, detectors, diaphragms, and horns.

621.392 **3175**

The Relation between Nodal Positions and Standing Wave Ratio in a Composite Transmission System.— E. Feenberg. (*J. appl. Phys.*, June 1946, Vol. 17, No. 6, pp. 530–532.) " Reflection generally occurs at a lossless transition region joining two uniform lossless lines. If the output line feeds into a matched load (no reflection) a standing wave ratio η_0 different from unity exists on the input side of the transition region. If the output line is terminated by a movable short circuit, a relation exists between the nodal positions on opposite sides of the transition section. The relation can be used to determine η_0 thus dispensing with the need for a calibrated detecting system to measure this quantity."

621.392 **3176**

Transmission Line Phenomena at Audio and Radio Frequencies.—H. Clark. (*Trans. S. Afr. Inst. elect. Engrs*, June 1946, Vol. 37, No. 6, pp. 149–158. Discussion, pp. 158–162.) An introduction to the theory of transmission lines based on the conception that free electrons in a conductor behave as the molecules of a gas, having random velocities when the conductor is isolated, but acquiring an additional drift velocity when a polarizing e.m.f. is applied.

621.392 : [534 + 535 **3177**

Extension of the Characteristic-Impedance] Concept to Acoustics, Optics, and to the Theory of Vibrating Strings.—Bedeau. (*See* 3262.)

621.392 : 621.317.33.029.64 **3178**

The Use of the Impedance Concept as Applied to Wave Guides.—G. Williams & H. C. Bolton. (*Phil. Mag.*, Dec. 1945, Vol. 36, No. 263, pp. 862–873.) The analogy between lines and waveguides is used to derive a waveguide method for the measurement of properties of dielectrics at centimetre wavelengths. Expressions corresponding to the *R*, *G*, *L*, and *C* of a line system are given for both *H* and *E* waves, and the method for dielectric measurement is first illustrated by reference to a coaxial line. Applying the impedance concept leads to an expression for the dielectric constant in terms of the wavelength in air, the cut-off wavelength of the guide, and the wavelength in the dielectric-filled guide. The latter is obtained from probe measurements of the wave pattern in the guide, and gives experimental results in agreement with those given by other methods.

621.392.2 + 621.396.44] : 551.574.7 **3179**

The Effect of Sleet on the Propagation of Carrier Waves along High-Voltage Transmission Lines.—Wertli. (*See* 3416.)

621.392.21 : 621.315.1 + 621.396.664] : 621.396.712 **3180**

The Design and Use of Radio-Frequency Open-Wire Transmission Lines and Switchgear for Broadcasting Systems.—F. C. McLean & F. D. Bolt. (*J. Instn elect. Engrs*, Part I, Aug. 1946, Vol. 93, No. 68, pp. 362–364.) Long summary of 2139 of August.

621.392.5 **3181**

Simplified Treatment of Some Main Points in the Theory of Quadripoles.—Guerbilsky. (*See* 3202.)

621.396.44 + 621.398] : 621.315.052.63 **3182**

Carrier-Current Communication over High-Voltage Transmission Lines.—Hancess. (*See* 3417.)

621.396.67 **3183**

Radiation Resistance of Loaded Antennas.—R. C. Raymond & W. Webb. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 114.) Experimental determinations have been made of driving-point impedances for antennas with various forms of metallic and dielectric loading. Resistances at resonance are compared with resistances calculated by the Poynting-vector method for assumed current distributions. For a given distribution the resistance is a function of only the length of the antenna in wavelengths. Measured current distributions fell between the curves for uniform and for sinusoidal distribution.

Abstract of an Amer. Phys. Soc. paper.

621.396.67 **3184**

Determination of the Electric Intensity near an Aerial Cage.—J. C. Simmonds. (*Phil. Mag.*, Nov. 1945, Vol. 36, No. 262, pp. 758–770.) Two methods are developed which enable the charge distribution and hence the electric intensity and corona voltage of an aerial cage to be determined. In the first, easily calculated up to a 6-wire cage only, the wires are assumed to be of diameter small compared with the distance apart, the charge distribution being evaluated in a determinant form. The other method is applicable when the cage is formed from a large number of wires, the distances apart being small compared with the cage diameter. Measurements on rubber-sheet models checked by the first method to within 5%, and were then used to confirm the second method.

621.396.67 **3185**

Simple Transmission Formula.—G. W. O. H. (*Wireless Engr*, Sept. 1946, Vol. 23, No. 276, pp. 235–236.) Discussion of the treatment by Friis (2282 of August) of the ratio of received power to transmitted power in terms of the " effective areas " of the aerials.

621.396.674 **3186**

Advantages of a Low-Impedance Loop for Broadcast Reception.—F. Bedeau. (*Rev. tech. Comp. franç. Thomson-Houston*, Jan. 1944, No. 1, pp. 59–71.) Comparison of the fields from electric and magnetic radiators of interference shows that a receiving aerial should be of the loop type to give the best signal/interference ratio. The reduction of antenna effect by balancing or screening the loop is essential for the best performance, and a single-turn loop, coupled by a suitable transformer to the input circuit of the receiver is the system recommended. The pick-up factor (***hauteur d'entrée***) is analysed for this system, and typical measured values in the bands 150–300 kc/s and 600–1 500 kc/s are given. See also 3187 (Vladimir).

621.396.674 **3187**

Low Impedance Loop Antenna for Broadcast Receivers.—L. O. Vladimir. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 100–103.) Low-impedance loops are easier to make and are less affected by age and humidity than the corresponding high-impedance loops. An account of the design of associated transformers is given, and curves show the conditions for maximum gain.

621.396.677 **3188**

A Generalised Radiation Formula for Horizontal Rhombic Aerials : Part 2.—H. Cafferata. (*Marconi Rev.*, April/June 1946, Vol. 9, No. 81, pp. 64–69.) Continuation of 1456 of June. The reflection factor of an imperfectly conducting earth and the general radiation formula for a perfect earth are derived, and the general equation for radiation from the array is set out. To be concluded.

621.396.677 **3189**

Dual-Rocket Antenna Characteristics. — G. Hendrickson. (*Radio, N.Y.*, July 1946, Vol. 30, No. 7, pp. 14–15.) Rocket antennas are described. They are longitudinally slotted cylinders, and the potential difference is applied across the slot. The radiation is similar to that from a large number of coaxial loops stacked one above the other. The radiation patterns and power gains are given for single and double rockets, and for an array of two double-rocket antennas. For the latter it is 7.5 db.

621.396.677 **3190**

Polar Diagrams : Experiments with a Half-Wavelength Receiving Aerial and a V-Type Wire-Netting Reflector.—J. S. McPetrie, L. H. Ford & J. A. Saxton. (*Alta Frequenza*, March/June 1945, Vol. 14, Nos. 1/2, pp. 119–122.) Long summary in Italian of 2612 of 1945.

621.396.677 : 621.398 **3191**

A Simple Method of Controlling the Beam Antenna.—E. Harris. (*Radio News*, Aug. 1946, Vol. 36, No. 2, pp. 60, 62.) A Wheatstone-bridge relay-operating circuit for the remote control of a rotating array.

621.315.052.63 + 621.317.083.7 **3192**

Télétransmissions par Ondes Porteuses dans les Réseaux de Transport d'Energie à Haute Tension. [Book Review]—A. Chevallier. Dunod, Paris, 111 pp., 124 fig. (*Wireless Engr*, Sept. 1946, Vol. 23, No. 276, p. 259.) Deals with the protection of h.v. networks by means of superposed h.f. currents.

CIRCUITS

518.5 : 621.3 **3193**

Computation Problems in Circuit Design.—Baker. (*See* 3365.)

621.314.2.029.5 : 621.396.621.54 **3194**

Two-Frequency I.F. Transformers.—Thompson. (*See* 3430.)

621.314.6 **3195**

A Note on Empirical Laws for Non-Linear Circuit Elements and Rectifiers.—D. B. Corbyn. (*Beama J.*, July 1946, Vol. 53, No. 109, pp. 245–252.) A theoretical treatment leads to the deduction of specific parameters analogous to specific resistance or conductance. It is shown that limitations are imposed on the values which the index n (of the current/voltage law) may take for either symmetrically or asymmetrically conducting elements such as rectifiers, and that n cannot in general be treated as a continuous variable.

621.318.7 + 537.228.1 **3196**

Piezo-Electric Crystals and Their Use in Electrical Wave Filters.—P. Scherrer & B. Matthias. (*Brown Boveri Rev.*, Sept. 1944, Vol. 31, No. 9, pp. 316–322.) Crystals of potassium and ammonium phosphate can be used with advantage in lattice band-pass filters for 10–100 kc/s. They can be artificially grown, they are more stable than Rochelle salt and give wider bandwidths than quartz crystals. The piezoelectric effect is explained using a mechanical model, and the insertion-loss characteristic of a filter using potassium phosphate crystals is graphed.

621.392 **3197**

Balancing System.—P. D. Andrews. (*Radio, N.Y.*, July 1946, Vol. 30, No. 7, p. 16.) A circuit is described for connecting a push-pull source to an unbalanced load. The primary feature is a special capacitor having two ganged variable sections built so that the series value of capacitance remains constant. Summary of U.S. patent 2 380 389.

621.392.091 **3198**

Simplified Method of Plotting Attenuation Curves.—L. S. Biberman. (*Radio, N.Y.*, July 1946, Vol. 30, No. 7, pp. 12–13.) Attenuation characteristics of many circuits plot as straight lines and circular arcs on semi-log paper. Illustrations are given.

621.392.4 **3199**

Link-Coupled Coil Design.—S. Sabaroff. (*Communications*, Aug. 1946, Vol. 26, No. 8, pp. 16–19, 45.) Analysis of a design procedure, assuming resistive loads. A nomogram is given.

621.392.43 **3200**

New Method of Impedance Matching in Radio-Frequency Circuits.—G. Guanella. (*Brown Boveri Rev.*, Sept. 1944, Vol. 31, No. 9, pp. 327–329.) Description of a transformer method depending on double-winding of coils, which can be used for impedance matching and for coupling symmetrical and unsymmetrical circuits. The matching remains substantially independent of frequency over a relatively wide range of the u.h.f. region.

621.392.43 **3201**

Electric Filters built up from Choke Coils and Condensers for Frequencies up to 60 kc/s.—K. Ebrat. (*Brown Boveri Rev.*, Sept. 1944, Vol. 31, No. 9, pp. 329–330.) Mentions points to be observed when using powdered-iron cores, and gives attenuation curves for filters to pass 0–1 000 c/s and 2.8–3.2 kc/s.

621.392.5 **3202**

Simplified Treatment of Some Main Points in the Theory of Quadripoles.—A. Guerbilsky. (*Ann. Radioélect.*, Jan. 1946, Vol. 1, No. 3, pp. 191–207.) The fundamental theorems of network theory are stated, and it is shown that, in general, three parameters determine any quadripole, while two are sufficient for a symmetrical quadripole.

Symmetrical quadripoles and the implications of Bartlett's theorem are discussed. Particular attention is devoted to the treatment in terms of lattice networks and their properties. An account of the asymmetrical quadripole is given, and its equivalence to a symmetrical quadripole followed by an ideal transformer is demonstrated.

Appendices deal respectively with transmission lines, the mid-band iterative impedance of a narrow-band-pass filter, and the approximate calculation of the propagation constant.

621.394./395].645.3 **3203**

Radio Design Worksheet No. 50.—Note on Analysis of Push-Pull Amplifiers with Negative Feedback.—(*Radio, N.Y.*, July 1946, Vol. 30, No. 7, p. 20.)

621.394/.397].645.22 **3204**

Transient Response of Tuned-Circuit Cascades.—D. G. Tucker. (*Wireless Engr*, Sept. 1946, Vol. 23, No. 276, pp. 250–258.) The response of an amplifier with N circuits, each with the same resonant frequency ω_0, to a pulse of carrier frequency ω is evaluated by repeated application of Duhamel's integral. When $\omega = \omega_0$ the envelope of the output pulse is found in terms of a series equivalent to the incomplete gamma function; when $\omega \neq \omega_0$ only the last (Nth) term of the series gives the envelope. "A comparison of the responses of tuned-circuit cascades with those of underived band-pass filters shows that for equal component qualities in the two cases, two tuned circuits in cascade are approximately equivalent, for pulse transmission applications, to a single-section band-pass filter using 50 per cent more components."

621.395/.397].645 : 621.396.619 **3205**

Carrier-Frequency Amplifiers.—C. C. Eaglesfield. (*Wireless Engr*, Sept. 1946, Vol. 23, No. 276, pp. 258–259.) An amendment to 1474 of June (Eaglesfield), suggested by van der Pol, concerning the influence of a linear 4-terminal network on a carrier with small amplitude or frequency modulation.

621.395.645.3 **3206**

Cathode Follower for Power Amplifier.—C. Stevens. (*Radio News*, Aug. 1946, Vol. 36, No. 2, pp. 52–54 . . 80.) Constructional details of an a.f. amplifier with a cathode-follower push-pull output stage.

621.396.24.029.63 **3207**

Development Work in the Decimetre Wave Field. —Schüpbach & de Quervain. (*See* 3361.)

621.396.611 **3208**

Average Frequency Stability [with deformation] **of Cavity Resonators.**—K. F. Niessen. (*Physica, 's Grav.*, Feb. 1942, Vol. 9, No. 2, pp. 145–157. In German.) For simplicity only deformations of a tensional form are considered. The axis of symmetry of the applied deformations is always chosen to be along one or other of the three principal axes of the cavity. One or two of these three deformations transform the original fundamental frequency to that of the deformed cavity while the other(s) lead to a higher frequency. The three new resulting frequencies are averaged. The frequency stabilities of the sphere and of the cube are very little different if the deformations satisfy the condition of constant surface area. The above is valid when only the linear terms in the frequency variation are taken into account. See also 3209 and 3210 below (Niessen).

621.396.611 **3209**

On the Frequency Stability of Certain Cavity Resonators in an Electric Circuit.—K. F. Niessen. (*Physica, 's Grav.*, June 1942, Vol. 9, No. 6, pp. 539–546. In German.) In deriving the frequency stability of cavities it is necessary to consider, in addition to the absolute value of the frequency variation, the average of such values when several deformations are possible. A comparison of the cube and the sphere is in favour of the former (about twice as good) for the case of expansion in one of the three mutually perpendicular dimensions when the other two dimensions contract so as to preserve constant surface area. The same applies for a contraction in one dimension instead of an expansion. On the basis of these calculations it is supposed that in general the cube exhibits the least frequency deviation when the two cavities are subjected to small irregular deformations. See also 3208 and 3210 (Niessen).

621.396.611 **3210**

Practical Remarks on the Frequency Stabilization of Spherical Cavity Resonators.—K. F. Niessen. (*Physica, 's Grav.*, July 1942, Vol. 9, No. 7, pp. 768–772. In German.) In order to reduce the frequency variations due to the expansion produced by the heating of the walls of a cavity resonator it is recommended that (*a*) the sphere be clamped between two diametrically applied supports whose spacing does not change with temperature ; the electric dipoles must be radial at the supports : (*b*) the sphere be clamped in a ring whose diameter is independent of temperature and the electric dipoles be arranged diametrically in the plane of the ring and in a radial direction. See also 3208 and 3209 (Niessen).

621.396.611.1 **3211**

Characteristic Oscillations of Solid Conductors and Electromagnetic Cavities.—P. Nicolas. (*Ann. Radioélect.*, Jan. 1946, Vol. 1, No. 3, pp. 181–190.) The periodic oscillations of a solid body or of a cavity are studied for the case of any shape. It is shown that there are preferred modes of oscillation which lead to particularly simple relations between the fields and currents. There is generally no geometrical relationship between the current distributions corresponding to two different characteristic modes. In general, on any surface, there are no preferred coordinates which lead to simplified relations between the fields and currents. The current distributions corresponding to free oscillations are closely connected with the characteristic modes. When a hollow resonator or a solid conductor is used it is almost always in the vicinity of one of its frequencies of free oscillation. It can be assumed that one of the characteristic modes of distribution preponderates and that the properties mentioned apply to the whole current-system in practice. All these results have been obtained by starting from the reciprocity theorem of electromagnetism.

621.396.611.1 : 534.13 **3212**

The Equivalent Circuit of a Spherical Vibrator.—Sacerdote. (*See* 3160.)

621.396.611.1.017 **3213**

***D* and *Q*.**—R. F. Field. (*Gen. Radio Exp.*, May 1946, Vol. 20, No. 12, pp. 5–8.) Expressions for power losses in a reactor are given in terms of the storage factor Q or its reciprocal D, the dissipation factor. Exclusive use of the latter is recommended, particularly where more than one source of loss is present.

621.396.615 **3214**

Synchronization and Frequency Division.—N. Carrara. (*Alta Frequenza*, Sept./Dec. 1945, Vol. 14, Nos. 3/4, pp. 134–160. With English, French and German summaries.) A general theoretical treatment of a resonant circuit connected to a two-terminal negative-resistance element. The condition for oscillation is established, and the system is classified as real or complex according as the discriminant of the second-order differential equation for the system is positive or negative. The synchronization and frequency-division characteristics of these types are separately considered, and the optimum conditions of operation are deduced. Oscillograms of the synchronizing process in a " real " oscillator are given.

621.396.615.029.63 **3215**

Composite Tank Circuit for U.H.F.—P. L. Bargellini. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 115–119.) A description of circuits, each comprising a resonant transmission line inside a resonant cavity, for use with negative-grid triodes. The arrangement gives a greater maximum frequency of oscillation, greater stability, and greater ease of coupling to the load than is obtained with an ordinary transmission-line circuit. For an earlier paper by the same author dealing with the same material see *Alta Frequenza*, Sept./Dec. 1945, Vol. 14, Nos. 3/4, pp. 161–174.

621.396.615.1 **3216**

Oscillator Power Relations.—R. E. Burgess. (*Wireless Engr*, Sept. 1946, Vol. 23, No. 276, pp. 237–240.) " The amplitude and power relations are derived for a class of valve-maintained oscillators in which the source of power can be represented as a negative-conductance element which has a characteristic limited by a term proportional to a higher odd-power of the voltage. The analysis is based on the classical work of E. V. Appleton and B. van der Pol. The coupling conditions for obtaining the maximum output power from such a source are deduced and shown to differ fundamentally from the impedance-match conditions appropriate to linear systems. It is shown that the intrinsic oscillatory-circuit losses are purely parasitic in the transfer of power to an external load-circuit, and there is no question of a resistance match.

" The response of such an oscillator circuit to a small external e.m.f. having a frequency different from the oscillation frequency is considered. It is found that the circuit effectively has a positive conductance which is proportional to the excess negative conductance producing oscillation."

621.396.615[.11 + .17 **3217**

Low-Frequency Oscillator using an Artificial Electric Line.—M. Federici. (*Alta Frequenza*, Sept./Dec. 1945, Vol. 14, Nos. 3/4, pp. 175–182. With English, French and German summaries.) A low-pass line having 100 sections (40 mH series, 10^4 $\mu\mu$F shunt) with a cut-off frequency of 16 kc/s is used as the feedback element of a triode circuit. The fundamental frequency of oscillation is 250 or 500 c/s according as the coupling transformer gives a phase shift of 0 or π. Oscillographic analysis of the waveform shows appreciable harmonic content. A four-section lattice network (130 mH series, 0.5 μF shunt) having a markedly non-linear phase/frequency characteristic shows that synchronization between the various constituent frequencies need not occur, *e.g.* in a typical case frequencies of 247 and 1 400 c/s were present. The oscillator can therefore be used to produce complex waveforms for special purposes.

621.396.615.11 **3218**

Two-Phase Resistance-Capacitance Oscillator.—G. B. Madella. (*Alta Frequenza*, March/June 1945, Vol. 14, Nos. 1/2, pp. 5–10. With English, French and German summaries.) The circuit uses a single-phase RC oscillator with a phase-shifter mechanically linked with the frequency control of the oscillator to give constant shift at all frequencies. It has the advantage of greater frequency stability and simplicity compared with the beat-frequency oscillator but does not provide such a wide frequency range. The model described has a range of 60–300 c/s, and a range of 8 : 1 should be possible by the use of a larger variable capacitor. The distortion of the output voltage is less than 2%.

621.396.615.17 **3219**

Wave Shaping Circuits.—S. Fishman. (*Radio Craft*, Aug. 1946, Vol. 17, No. 11, pp. 761, 793.) Simple explanation of the action of diode and triode limiters used as square-wave generators.

621.396.615.17 : [621.317.755 + 621.397.331.2 **3220**

Current Oscillator for Television Sweep.—G. C. Sziklai. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 120–123.) The inadequacies of previous saw-tooth current oscillators for magnetic deflexion are reviewed, and the basic principles of the requirement are outlined. A circuit is described, with circuit diagrams, which gives a sweep of excellent linearity with adequate amplitude to give full deflexion in a 12-inch 38-degree kinescope. Specifications of the oscillator transformer and dual filament choke are given.

621.396.619 **3221**

Class B Modulator Design.—R. M. W. Grant. (*Marconi Rev.*, April/June 1946, Vol. 9, No. 81, pp. 70–87.) A theoretical discussion of the design of the output filter generally used with high-power class-B modulators.

621.396.621.029.64 **3222**

Low Noise Microwave Video Receiver Design.—Zable. (*See* 3407.)

621.396.645 **3223**

Design of Broad Band I.F. Amplifiers.—R. F. Baum. (*J. appl. Phys.*, June 1946, Vol. 17, No. 6, pp. 519–529.) A treatment of the problem for stagger-tuned stages, each consisting of a single tuned circuit, with an extension to the case of stages containing two magnetically coupled circuits. " It is found that the figures of merit (Q_n) of the individual circuits should be related to the Q of a reference circuit according to :

$$Q/Q_n = \sin\left[(2m + 1)\pi/2t\right] \cdot \frac{\omega_0}{\omega_{0n}},$$

$$m = 0, 1, 2, \ldots (t - 1).$$

Then, by proper tuning, either an oscillatory or a monotonic response may be obtained. The relative band width BW/f_0 and the gain tolerance d_0 within the band determines the value of Q. The minimum number of stages for a given minimum attenuation in the cut-off region depends only on the gain tolerance and on the desired kind of response. Gain maxima (attenuation minima) appear at frequency deviations $\Delta f_n^{\min}$ from middle-band frequency f_0 given by :

$$2\Delta f_n^{\min}/BW = \cos\left[(2m + 1)\pi/2t\right].$$

Their location depends only on the number of stages The resonance deviations Δf_{0n} of the tuned circuits are proportional to $\Delta f_n^{\min}$ with a proportionality factor F dependent on t and d_0. The circuit impedances are calculated from a prescribed gain or from the maximum attainable gain. A formula for the maximum gain band-width product is derived."

621.396.662.2 **3224**

Tracking Permeability-Tuned Circuits.—A. W. Simon. (*Electronics*, Sept. 1946, Vol. 19, No. 9, p. 138.) A brief account of the theory, with worked-out examples.

621.396.662.34 : 621.396.611.21 **3225**

Generalised Curves for the Design of the Two-Crystal Bandpass Filter.—J. D. Brailsford. (*Marconi Rev.*, April/June 1946, Vol. 9, No. 81, pp. 40–63.) Development of a design technique. The curves give the transmission loss of the filter used as an inter-valve coupling. The effect of crystal mismatching is taken into account, and a note is included on the use of mechanically coupled crystals.

621.396.665 **3226**

Surgeless Volume Expander.—A. N. Butz, Jr. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 140, 142.) Description of a circuit which balances out anode-current surges without recourse to push-pull operation.

621.396.667 **3227**

Tone Control Circuits.—Wortman. (*See* 3170.)

621.397.813 **3228**

Theoretical Investigation of the Distortion of Television Signals in Valve Circuits.—J. Huber, (*Schweiz. Arch. angew. Wiss. Tech.*, April 1945. Vol. 11, No. 4, pp. 115–127.) Conclusion of 901 of April.

GENERAL PHYSICS

53.081 **3229**

A Discussion on Units and Standards.—(*See* 3341.)

531.3 **3230**

On the Process of Establishment of Oscillatory Systems with One Degree of Freedom.—V. V. Kasakevitch. (*C.R. Acad. Sci. U.R.S.S.*, 10th Dec. 1945, Vol. 49, No. 7, pp. 486–489. In French.)

535.1 **3231**

Change of Frequency of a Light Wave by the Variation of Its Optical Path.—T. L. Ho & W. S. Lung. (*Nature, Lond.*, 13th July 1946, Vol. 158, No. 4002, p. 63.) A formula is derived and applied to various types of waves; application to material waves gives confirmation of the relation $E = h\nu$, and represents one type of energy change for photons. A more generalized formula is proposed which represents a second type of energy change, and which also explains the effect on frequency of a doubly refracting medium.

535.215+621.383 **3232**

Influence of Polarized Light on the Falling-Off Effect of the Limiting Potential of Einstein's Photoelectric Law.—E. Marx. (*Phys. Rev.*, 1st/15th May 1946, Vol. 69, Nos. 9/10, pp. 523–529.)

535.34 **3233**

Nuclear Electric Quadrupole Moment and the Radiofrequency Spectra of Homonuclear Diatomic Molecules.—B. T. Feld. (*Phys. Rev.*, 1st/15th July 1946, Vol 70, Nos. 1/2. p. 112.) Abstract of an Amer. Phys. Soc. paper.

535.343.4+621.396.11.029.64+538.569.4 **3234**

The Absorption of Microwaves by Gases.—W. D. Hershberger. (*J. appl. Phys.*, June 1946, Vol. 17, No. 6, pp. 495–500.) The full paper, of which an abstract was noted in 1336 of May. Fourteen gases including ammonia, dimethyl ether, various amines, and alkyl halides have shown strong absorptions at microwavelengths. Measurements of the absorption coefficient and permittivity of these at 1.25 cm wavelength and atmospheric temperature and pressure are given. The frequencies for maximum absorption are derived from absorption/pressure curves. Data on the absorption of several gas mixtures are given, and possible molecular mechanisms are discussed. See also 3235, 3236, 3238, and back references.

535.343.4+621.396.11.029.64 **3235**

Expected Absorption in the Microwave Region by Water Vapour and Similar Molecules.—R. M. Hainer, G. W. King & P. C. Cross. (*Phys. Rev.*, 1st/15th July, Vol. 70, Nos. 1/2, pp. 108–109.) "To predict microwave absorption it is necessary to determine all possible transitions [up to $J\sim12$] between asymmetric rotor levels about one wave number apart. . . . Exact values of the energies and transition probabilities of H_2O were calculated and the position and intensity of absorption in the microwave region determined." The work has been extended to D_2O, HDO, H_2S, H_2Se, D_2Se. See also 3234.

Abstract of an Amer. Phys. Soc. paper.

535.343.4+621.317.011.5+621.396.11.029.64] : **3236**
546.171.1

The Inversion Spectrum of Ammonia.—W. E. Good. (*Phys. Rev.*, 1st/15th May 1946, Vol. 69, Nos. 9/10, p. 539.) The strong absorption band of NH_3 at 0.8 cm^{-1} has been resolved into 28 sharp, widely separated lines, using a variable-frequency continuous-wave source. A graph of the frequencies and intensities of the lines is given, and the empirical expression for the frequencies compared with previous theoretical and experimental results. The lines were observed at about 0.1 mm Hg pressure by inserting the gas in a waveguide between a frequency-modulated source and detectors connected to a cathode-ray display. A hyperfine structure is resolved at about 10^{-2} mm Hg pressure. For an abstract of an Amer. Phys. Soc. paper based on this work see *Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 109. See also 2622 of September (Bleaney & Penrose), and back reference.

535.343.4+621.317.1.011.5 **3237**
+621.396.11.029.64] : 546.171.1

Ammonia Spectrum in the 1 cm Wavelength Region.—B. Bleaney & R. P. Penrose. The cross reference to this paper given in 2536 of September as "*See* 2662" should read "*See* 2622".

535.343.4+621.396.11.029.64] : 546.171.1 **3238**

Resolution and Pressure Broadening of the Ammonia Spectrum Near One-cm Wave-Length.—C. H. Townes. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 109.) Twelve lines were resolved and examined in the band 22.840–25.046 kMc/s at pressures less than 1 mm Hg. Detailed examination of one line yielded a collision frequency of 1.7×10^8 sec^{-1}. See also 3236 and back references.

Abstract of an Amer. Phys. Soc. paper.

535.343.4 : 535.61–15 : 546.212.02 **3239**

The Infra-Red Spectrum of Heavy Water.—F. P. Dickey & H. H. Nielsen. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 109.) Abstract of an Amer. Phys. Soc. paper.

535.376 **3240**

Cathodo-Luminescence: Part 1—Growth and Decay Processes; Part 2—Current Saturation and Voltage Effects; Part 3—Discussion of Results.—J. W. Strange & S. T. Henderson. (*Proc. phys. Soc.*, 1st July 1946, Vol. 58, No. 328, pp. 369–383, 383–391 & 392–401.) Experimental results show that processes of exponential form occur widely in growth and decay of light output from inorganic phosphors. The simple theory relating to monomolecular or random-type processes fails to account for the complexity of the results. There is no definite evidence in favour of bimolecular decay, though non-exponential processes are found to be present in the growth at low current densities and in the decay at long times after excitation.

Measurements have been made of the light output from phosphors under steady electron beams at constant voltage and varying current density, and "current saturation" has been found to vary greatly in extent for different materials. Similarly the change of light output with varying voltage at constant current density shows different characteristics for different phosphors, but without the expected variation on changing the current density.

The interpretation of the experimental results is inadequate due to insufficient knowledge of electron absorption in phosphors. There is some evidence of a new type of voltage absorption law.

536.4+536.5 **3241**

A New Form of Chart for Determining Temperatures in Bodies of Regular Shape during Heating or Cooling.—A. J. Ede. (*Phil. Mag.*, Dec. 1945, Vol. 36, No. 263, pp. 845–851.)

537.122 : [537.212+538.12 **3242**

On a Free Electron Gas in Static Magnetic and Electric Fields.—J. Lindhard. (*Ark. Mat. Astr. Fys.*, 26th Aug. 1946, Vol. 33, Part 1, Section A, No. 4, 17 pp. In English.) A theoretical paper.

537.221 **3243**

Contact Potential Difference in Crystal Rectifiers.—Meyerhof. (*See* 3465.)

537.228.1 **3244**

Forced Vibrations of Piezoelectric Crystals.—H. Ekstein. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, pp. 76–84.) " The vibrations of anisotropic bodies under the influence of sinusoidally variable volume forces and boundary stresses are investigated. The displacement components are represented as sums of a system of " zero-order " solutions which solve approximately the free-vibration problem. By using Betti's theorem, the problem is reduced to a system of inhomogeneous linear equations which, for the free-body case, further reduces to the homogeneous system derived in an earlier paper. If the external forces are piezoelectric, the forces are no longer given explicitly because the electrical field distribution is known only if Maxwell's equations are solved simultaneously. However, if the pertinent piezoelectric constants are small, the field can be calculated approximately as if the crystal were not vibrating. The solutions can then be obtained by the above method, and the electric reaction of the crystal upon the driving system can be determined. As an example, forced vibrations of thin quartz plates between parallel electrodes are discussed."

For previous work by the author see 523 & 3645 of 1945.

537.533.72 + 621.385.833 **3245**

The Variation of Resolution with Voltage in the Magnetic Electron Microscope.—V. E. Cosslett. (*Proc. phys. Soc.*, 1st July 1946, Vol. 58, No. 328, pp. 443–455.) A theoretical consideration of spherical and chromatic aberrations, diffraction error, and total error. The calculations indicate that there are definite optimum conditions of operation for a given lens.

537.56 : 621.396.11 **3246**

Conduction and Dispersion of Ionized Gases at High Frequencies.—H. Margenau. (*Phys. Rev.*, 1st/15th May 1946, Vol. 69, Nos. 9/10, pp. 508–513.) " The distribution in energy of electrons in a high frequency electromagnetic field is derived by kinetic theory methods. By use of the distribution law, the current density and hence the (complex) conductivity are calculated as functions of electron density, pressure, and frequency of the field. The real part of the conductivity has a maximum for gas pressures, or frequencies, such that the mean free time of an electron is approximately equal to the period of the field. From the conductivity, the dielectric constant of the medium, its index of refraction, and its extinction coefficient are deduced. The results are applicable in microwave researches and in ionosphere problems."

538 **3247**

Unipolar Magnetic Charges (Poles).—F. Ehrenhaft. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 114.) Abstract of an Amer. Phys. Soc. paper.

538.114 **3248**

Magneto-Resistance and Domain Theory.—R. M. Bozorth. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 106.) " Changes in resistivity at saturation in longitudinal and transverse fields have been measured for alloys containing 40–100% nickel, and these are compared with the changes due to tension."

Abstract of an Amer. Phys. Soc. paper.

538.12 **3249**

A New General Theory of the [magnetic] **Coercive Field.**—L. Néel. (*C.R. Acad. Sci., Paris*, 22nd July 1946, Vol. 223, No. 4, pp. 198–199.)

538.14 **3250**

Magnetic Domain Patterns on Silicon-Iron Crystals.—H. J. Williams. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 106.) Abstract of an Amer. Phys. Soc. paper.

538.247 **3251**

The Demagnetizing Factors for Ellipsoids.—E. C. Stoner. (*Phil. Mag.*, Dec. 1945, Vol. 36, No. 263, pp. 803–821.)

538.3 : 530.12 **3252**

Relative Nature of Electromagnetic Radiation.—H.-P. Soh, M.-H. Wang & S.-C. Kiang. (*Nature, Lond.*, 15th June 1946, Vol. 157, No. 3998, p. 809.)

538.32 : 621.385.832 **3253**

An Analysis of Electromagnetic Forces.—A. Gronner. (*Elect. Engng, N.Y.*, June 1946, Vol. 65, No. 6, pp. 300–302.) A letter commenting on 587 of March (Tripp) explaining the forces between electrons in parallel motion in terms of relativity theory. See also 2547 of September (Burgess : G.W.O.H.)

538.652 **3254**

The Effect of Transverse Magnetic Field on the Longitudinal Joule Magnetostriction Effect in Nickel.—O. P. Sharma. (*Indian J. Phys.*, Oct. 1945, Vol. 19, No. 5, pp. 202–209.) The effect predicted by Williams (*Phys. Rev.*, 1912, Vol. 34, p. 289), that a transverse field would produce an additional change in length of a longitudinally magnetized rod is confirmed experimentally.

539.3 **3255**

Impedance Representation of Tangential Boundary Conditions.—G. D. Camp. (*Phys. Rev.*, 1st/15th May, 1946, Vol. 69, Nos. 9/10, pp. 501–502.) The tensor formulation of an elastic system is given, and the method applied to the tangential impedance for the plane boundary of a viscous fluid.

548.0 : 547.476.3–162 **3256**

Structure and Thermal Properties of Crystals : Part 6—The Role of Hydrogen Bonds in Rochelle Salt.—A. R. Ubbelohde & I. Woodward. (*Proc. roy. Soc. A*, 5th April 1946, Vol. 185, No. 1003, pp. 448–465.)

621.317.39 : 535.34 **3257**

The Measurement of Nuclear Spin, Magnetic Moment, and Hyperfine Structure Separation by a Microwave Frequency-Modulation Method.—Roberts, Beers & Hill. (*See* 3347.)

621.317.39.029.64 : 537.312.62 : 546.815–1 **3258**

Superconductivity of Lead at 3-Cm Wave-Length.—F. Bitter, J. B. Garrison, J. Halpern, E. Maxwell, J. C. Slater & C. F. Square. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, pp. 97–98.) Outline of experiments and equipment used at a wavelength of 3.2 cm. The lead sample was in the form of a resonant cavity, the Q of which was measured by taking resonance curves using the variable-frequency signal from a medium-wave generator mixed with the output from a stabilized klystron as the signal source. "The best indications . . . indicate a conductivity at 4° K of 10^6 times as great as at room temperature . . ." The values of Q measured were of the order of 10^6.

621.384 **3259**

The Stability of Synchrotron Orbits.—Dennison & Berlin. (*See* 3440.)

621.384 **3260**

The Racetrack : a Proposed Modification of the Synchrotron.—H. R. Crane. **The Stability of Orbits in the Racetrack.**—D. M. Dennison & T. H. Berlin. (*Phys. Rev.*, 1st/15th May 1946, Vol. 69, Nos. 9/10, pp. 542 & 542–543.)

621.385.82 **3261**

High-Frequency Discharge as an Ion Source.—P. C. Thonemann. (*Nature, Lond.*, 13th July 1946, Vol. 158, No. 4002, p. 61.) A 10-mA current of positive hydrogen ions has been drawn from an h.f. discharge and focused into a beam by a direct potential difference of 20 kV. Use of a magnetic field may increase the current.

621.392 : [534+535 **3262**

Extension of the Characteristic-Impedance Concept to Acoustics, Optics, and to the Theory of Vibrating Strings.—F. Bedeau. (*Rev. tech. Comp. franç. Thomson-Houston*, April 1946, No. 5, pp. 21–30.) A generalized treatment of characteristic impedance Z arrived at independently of Schelkunoff's work (1740 of 1938). The Z for a longitudinal sound wave is given by $\sqrt{\rho E}$ ($\rho =$ density of medium, $E =$ elasticity), and, for a transverse sound wave, as for a vibrating string, by $\sqrt{\mu\tau}$ ($\mu =$ mass per unit length, $\tau =$ tension). In e.m.u. the characteristic impedance and velocity of waves in a transparent medium are equal. The application of these concepts to acoustical and optical problems is illustrated.

621.395.822 : 621.315.59 **3263**

Electrical Contact Noise.—M. H. Greenblatt, P. H. Miller, Jr., & L. I. Schiff. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 113.) A theory is given of the low-frequency noise observed in biased electrical contacts involving semiconductors, based on diffusion of impurities between semiconductor and interface region where large electric fields exist. Preliminary experiments give confirmation of the theory on variation of noise power with frequency, back-bias current, and temperature.

Abstract of an Amer. Phys. Soc. paper.

621.396.029.64 **3264**

Elementary Physics of Ultra-Short Waves.—P. Grivet. (*Onde élect.*, April & May 1946, Vol. 26, Nos. 229 & 230, pp. 135–148 & 188–203.) A survey of the special characteristics of centimetre waves and of the theory of their generation by triode and velocity-modulated valves, with detailed description of typical valves. The second section gives a general account of guided waves and of horn types of radiator. Appendices give more detail of the theory of electron beams, of dielectric losses, and of attenuation. In particular, a development of guided-wave phenomena in terms of the interference patterns arising from reflections from the walls of the guide is given. Bibliography of 55 items.

621.396.611 **3265**

Electromagnetic Field in Cavity Resonators.—M. Abele. (*Alta Frequenza*, March/June 1945, Vol. 14, Nos. 1/2, pp. 96–116. With English, French and German summaries.) A general analysis of the field inside cavities bounded by surfaces of revolution, neglecting dielectric and ohmic losses. Only those cases are considered in which no meridian plane is a nodal plane both for the electric and for the magnetic field. The location of the points of zero electric field is indicated, and enables the qualitative configuration of the field to be rapidly determined. The theory is applied to the behaviour of a toric and of an almost cylindrical cavity at their fundamental modes.

621.396.822+537.525.5] : 621.385 **3266**

Noise and Oscillations in Hot-Cathode Arcs.—J. D. Cobine & C. J. Gallagher. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 113.) Positive ions oscillate in two regions of the discharge, the plasma, and the potential minimum at the cathode; the disturbances appear as voltage variations between the electrodes. "Plasma" oscillations are usually below 400 kc/s and "cathode" oscillations about 700 kc/s. Random noise depends on current, increasing rapidly as Townsend discharge changes into an arc. Noise voltage was investigated under various conditions by a probe technique. See also 3267.

Abstract of an Amer. Phys. Soc. paper.

621.396.822 + 537.525.5] : 621.385 **3267**

Effect of Magnetic Field on Noise and Oscillations in Hot-Cathode Arcs.—C. J. Gallagher & J. D. Cobine. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 113.) Oscillations in gas discharges discussed in 3266 above are affected by a magnetic field transverse to the normal flow of currents. Oscillations are transmitted to the electrodes by electrons velocity-modulated by the plasma oscillations. A critical value of field suppresses oscillation and reduces noise to a minimum. Higher values give increased noise above 1 Mc/s.

Abstract of an Amer. Phys. Soc. paper.

621.396.822 **3268**

Statistical Analysis of Spontaneous Electrical Fluctuations.—Fürth & MacDonald. (*See* 3411.)

53 : 621.38 **3269**

Traité de Physique Électronique. [Book Review] —L. Chrétien. E. Chiron, Paris, 368 pp. (*Onde élect.*, June 1946, Vol. 26, No. 231, p. 17A.) "The fundamentals . . in popular form . . Nothing essential is sacrificed."

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.16 : 621.396.822 **3270**

Cosmic Radiations at 5 Metres Wave-Length.—J. S. Hey, J. W. Phillips & S. J. Parsons. (*Nature, Lond.*, 9th March 1946, Vol. 157, No. 3984, pp. 296–297.) The intensity distribution of cosmic-noise power-flux at 64 Mc/s was measured with a radio receiver using a Yagi aerial system providing a beam width to half power of ± 6° in elevation and ± 15° in bearing. The results are presented in the form of a contour map. The contours are roughly symmetrical with respect to the galactic equator. The main source is in the direction of the galactic centre, a second peak is at R.A.2030 hr, Dec. + 35° in Cygnus. The intensity in the first peak is given as $13.2 \times 10^{-21} \Delta\nu \, \Delta\omega$ W/sq. inch where $\Delta\nu =$ bandwidth in c/s and $\Delta\omega =$ solid angle in steradians.

523.16 : 621.396.822 **3271**

Interstellar Origin of Cosmic Radiation at Radio-Frequencies.—J. L. Greenstein, L. G. Henyey & P. C. Keenan. (*Nature, Lond.*, 15th June 1946, Vol. 157, No. 3998, pp. 805–806.) Measurements of the intensity of cosmic electromagnetic radiation (see 1823/1826 of July and back references, and 3270 above) show good agreement with computed values based on the theory of radiation arising from free-free transitions by electrons in the field of protons, using the accepted figures for the number of protons and electrons.

523.165 : 523.3 **3272**

A Lunar Effect on Cosmic Rays?—A. Duperier. (*Nature, Lond.*, 9th March 1946, Vol. 157, No. 3984, p. 296.) Harmonic analysis of average solar daily inequalities reveals the existence of a semi-diurnal variation, nearly opposite in phase to the semi-diurnal barometric oscillation. It is deduced that the moon may, by altering the height of the meson-producing layer, affect the intensity of cosmic rays at ground level.

523.165 **3273**

Solar and Sidereal Diurnal Variations of Cosmic Rays.—A. Duperier. (*Nature, Lond.*, 10th Aug. 1946, Vol. 158, No. 4006, p. 196.) Analysis of observations over the last 3 years indicates a seasonal change in the intensity of cosmic radiation. The variation of the time of maximum intensity may also be taken as evidence of a sidereal variation. The maximum and minimum values of the solar variation, 0.77% and 0.06% respectively, may be correlated with the change of solar zenith distance. It is suggested that part of the cosmic radiation may originate in the sun and part in the galaxy.

523.165 **3274**

The East-West Asymmetry of Cosmic Radiation at a Geomagnetic Latitude of 28°31′ and an Estimation of the Difference of the Exponents of the Absorption Law for the Polar and the Equatorial Regions.—F. Oster, S. L. Ch'u & L-Y. Lü. (*Phys. Rev.*, 1st/15th May 1946, Vol. 69, Nos. 9/10, p. 531.)

523.7 **3275**

General Magnetic Field of the Sun.—T. G. Cowling. (*Nature, Lond.*, 6th July 1946, Vol. 158, No. 4001, p. 31.) Abstract of a paper in *Mon. Not. R. astr. Soc.*, surveying the various theories. The view that the material in the far interior of the sun is capable of permanent magnetization is considered worthy of further investigation.

523.74 " 1942.02/.03 " **3276**

Solar Eruption of February-March, 1942.—B. Edlén. (*Nature, Lond.*, 9th March 1946, Vol. 157, No. 3984, p. 297.) Reminder of the decreased cosmic-ray intensity, and the increased intensity of the 5694 Å line, produced on this occasion.

523.78 : [551.51.053.5 + 621.396.11 **3277**

The Solar Eclipse of 1945 and the Propagation of Radio Waves.—R. L. Smith-Rose. (*Alta Frequenza*, March 1946, Vol. 15, No. 1, pp. 37–38.) Long summary in Italian of 1831 of July.

551.51.053 **3278**

Meteorology of the Lower Stratosphere.—G. M. B. Dobson, with A. W. Brewer & B. M. Cwilong. (*Proc. roy. Soc. A*, 12th Feb. 1946, Vol. 185, No. 1001, pp. 144–175.) Methods of measuring the amounts of water vapour, carbon dioxide, and ozone in the upper atmosphere are described, and the meteorological conditions at these levels discussed. Bakerian Lecture.

551.51.053.5 **3279**

Detection of Rapidly Moving Ionospheric Clouds.—H. W. Wells, J. M. Watts & D. E. George. (*Phys. Rev.*, 1st/15th May 1946, Vol. 69, Nos. 9/10, pp. 540–541.) Observations were made during the magnetic storm of 25th–26th March 1946 with a new panoramic recording technique that enables the frequency range 1.5–20 Mc/s to be swept in a time adjustable from 5 to 30 seconds. The ionospheric clouds were observed to move in from 800–900 km down to 300–400 km at a rate of 1–2 km/s, and sometimes to move out again at a similar rate. " The principal effects of influx of the clouds are: (1) sudden changes in *F*-layer ionization; (2) rapid changes in *F*-layer heights indicating turbulence which is often progressive from high to low heights and from high to low frequencies; (3) rapid fluctuations of echoes at the lower frequencies with occasional temporary disappearance indicating high absorption."

The clouds are provisionally attributed to corpuscular ionization during magnetic disturbances, indicating a corpuscular contribution to *F*-layer ionization.

An inaccurate account of these observations was noted in 2889 of October.

551.51.053.5 **3280**

Geophysics of the Ionosphere.—J. W. Cox. (*Nature, Lond.*, 10th Aug. 1946, Vol. 158, No. 4006, pp. 189–191.) Report of a discussion at the Royal Astronomical Society. Appleton surveyed the present state of knowledge of the ionosphere layers and pointed out some of the outstanding problems. Mumford spoke on reciprocity of transmission and reception. Kirke described experiments on lateral deviation between Daventry and New Delhi, and also asked that attenuation on long routes and the influence of the gyromagnetic frequency should be further studied. Cox described the wartime work of the (British) Inter-Service Ionospheric Bureau. Hey spoke on solar noise and scatter bursts. Massey spoke on the processes of recombination and attachment.

551.51.053.5 : 523.746 **3281**

The Ionosphere as a Measure of Solar Activity.—M. L. Phillips. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 119.) Critical frequencies (f^0) of regular ionospheric layers vary as $f^0 = F_1(t) + F_2(t)S$ where t is time of day and S the sunspot number. Where ionospheric trends are well established, observations of critical frequency may be used to determine an ionospheric "sunspot number". Using F_2 layer observations around local noon, the ionospheric " sunspot number " probably presents a more precise index of solar activity than the ordinary sunspot number.

Abstract of an Amer. Phys. Soc. paper.

LOCATION AND AIDS TO NAVIGATION

534.88 **3282**
Echo Depth Sounder for Shallow Water.—Shaw. (*See* 3163.)

534.88 : 534.321.9 **3283**
The "Sonicator".—(*See* 3164.)

621.396.677.1 **3284**
The Mutual Perturbations of Two Loop Direction Finders.—F. Penin. (*Onde élect.*, March 1946, Vol. 26, No. 228, pp. 101–106.) It is shown that the minimum separation between two direction finders for freedom from errors within a given standard depends on the diameter of the loops, their type of winding, and effective Q values. In particular, it is shown that separation of two or three metres is adequate for the types of direction finder mounted in aircraft.

621.396.9 **3285**
Radar.—E. G. Schneider. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1946, Vol. 34, No. 8, pp. 528–578.) A comprehensive survey of the principles, problems, and techniques.

621.396.9 **3286**
The Scientific Principles of Radiolocation.—E. V. Appleton. (*Alta Frequenza*, Sept./Dec. 1945, Vol. 14, Nos. 3/4, pp. 230–232.) A long summary in Italian of 3777 of 1945.

621.396.9 **3287**
An Introduction to Hyperbolic Navigation, with Particular Reference to Loran.—J. A. Pierce. (*J. Instn elect. Engrs*, Part III, July 1946, Vol. 93, No. 24, pp. 243–250.) "Hyperbolic navigation is achieved when synchronized signals, having a known velocity of propagation, are transmitted from at least three known points, and when the relative times of arrival of these signals are known and measured by a navigator." For Loran, pulse transmitters, (frequency 1.70–2.00 Mc/s) synchronized by ground-wave (Standard Loran) or sky-wave (SS Loran), are at the known points.

The accuracy of Standard Loran is about 300 yards at short distances and about 1 mile in the ground-wave service area, 700 miles by day, 500 miles by night over sea. For sky-wave working at night the error is 1½–8 miles for ranges of 300–1 400 miles. In SS Loran the minimum average error of fix is 0.9 nautical miles due to variations in ionosphere heights. Low Frequency Loran, at present under development, should have day or night range of at least 1 000 miles, but with lower accuracy than Standard Loran.

Summary and I.E.E. discussion of an I.R.E. paper.

621.396.9 **3288**
The Loran System.—(*Alta Frequenza*, March 1946, Vol. 15, No. 1, pp. 48–52.) Long summary in Italian of 605 of March.

621.396.9 **3289**
The Civil Application of Radar.—E. G. Bowen. (*Proc. Instn Radio Engrs, Aust.*, June 1946, Vol. 7, No. 6, pp. 4–10.) A short account of applications to civil aviation, marine navigation, surveying, and meteorology. An airborne distance indicator is described for measuring range from an airport, with 2% accuracy up to 120 miles at 8 000 ft flying height. A multiple track radar range (MTR) under development uses the Gee principle (see 3916 of 945—Harley) but with ground transmitters 5–10 miles apart. An aircraft located to ± 20 yd relative to two radar beacons 200 miles apart can be used for the photographic surveying of an area of about 200 000 square miles. The importance to the meteorologist of scatter from raindrops is mentioned. For two previous lectures see 1854 of July and 2907 of October.

621.396.9 (44) **3290**
On French Contributions to the Technique of Electromagnetic Detection [of objects]**.**—M. Ponte. (*Ann. Radioélect.*, Jan. 1946, Vol. 1, No. 3, pp. 171–180.) Historical survey of radiolocation developments in France by the C.S.F. (Compagnie Générale de T.S.F.) and the S.F.R. (Société Française Radioélectrique).

In 1935 c.w. obstacle detectors on wavelengths of 80 cm and 16 cm were fitted to ships and installed at harbours giving ranges of about 5 km on ship targets.

In 1936–38 higher power magnetrons and pulse modulation technique were developed: peak power 10 W at λ 16 cm with 6-μs pulses.

Later developments included increase of power to 4 kW on λ 16 cm, use of 1-μs pulses, superheterodyne receivers with c.r. indication, and horn radiators. A system installed at Toulon in 1942 gave ranges up to 25 km on large ships with an accuracy of 25 m in range and 2–3° in azimuth. Systems on λ 3 m with a peak power of 25 kW were also developed. The paper contains 18 photographs of the systems described

621.396.9 : 621.396.932 **3291**
Radio Aids for Ships.—(*Nature, Lond.*, 25th May 1946, Vol. 157, No. 3995, p. 689; *Engineering, Lond.*, 10th May 1946, Vol. 161, No. 4191, pp. 451–452.) International meeting, with demonstrations of war-time devices and their peace-time applications. See also *Engineer, Lond.*, 7th June 1946, Vol. 181, No. 4717, p. 527 for a fuller description of one of the new models.

621.396.9 : 621.396.932 **3292**
The Electronic Navigator.—T. Grover & E. C. Kluender. (*Communications*, Aug. 1946, Vol. 26, No. 8, pp. 30..39.) Technical description of a 10-cm wavelength merchant-ship surface-search and navigational radar with range 200 yards, or less in favourable conditions, to 30 miles. P.p.i. display is used, and bearings are indicated by a selsyn unit.

621.396.91 **3293**
Static [atmospherics] **Direction Finder.**—H. L. Knowles. (*Phys. Rev.*, 1st/15th May 1946, Vol. 69, Nos. 9/10, p. 546.) An apparatus developed for the U.S. Army Signal Corps. It consists of the usual crossed-loop aerials feeding twin amplifiers, with c.r. tube display, the orientation of the trace giving the azimuth of the incoming signal The method of determining the position of the storm area by synchronized observations at three stations is discussed. Abstract of an Amer. Phys. Soc. paper.

621.396.931/.933].22.029.5 **3294**
Better Direction Finder.—E. D. Padgett. (*Radio Craft*, Aug. 1946, Vol. 17, No. 11, pp. 750..805.) Description of the Simon Radioguide, and its U.S. military version SCR-503-A. For a previous account see 1545 of June.

621.396.933 **3295**
All-Weather Flying.—G.T.M. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 84–87.) A general review

of available radio aids, giving an account of the state of progress towards their adoption for civil flying in the U.S.

621.396.933 **3296**

Aviation Radio.—Newstead. (*See* 3425.)

621.396.933.23 **3297**

Blind Approach Systems.—D. Brice. (*Aeroplane*, 9th Feb. 1945, Vol. 68, No. 1759, pp. 165–167.) A general description of the Standard Beam Approach and American Radio Range systems.

621.396.9 **3298**

Introduzione alla Radiotelemetria. [Book Review] —U. Tiberio. Editore Rivista Marittima Roma, 1946, 277 pp., 137 figs., 300 lire. (*Wireless Engr*, Sept. 1946, Vol. 23, No. 276, p. 259: *Alta Frequenza*, March 1946, Vol. 15, No. 1, pp. 62–64.) Introduction to radar.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 **3299**

A Multiple High-Vacuum Valve.—R. I. Garrod. (*J. sci. Instrum.*, Aug. 1946, Vol. 23, No. 8, p. 191.) Design details of a valve to permit the simultaneous or independent exhaustion of four separate vacuum sections.

533.5 **3300**

Leaking and Controlling Small Quantities of Gas.—A. S. Husbands. (*J. sci. Instrum.*, Aug. 1946, Vol. 23, No. 8, pp. 190–191.) A method of control of the gas pressure in discharge tubes using a fixed inlet leak (a porous Steatite pellet), and a variable needle-type valve in the exhausting tube.

535.37 **3301**

Effect of Absorption on Decay of Infra-Red Sensitive Phosphors.—R. T. Ellickson & W. L. Parker. (*Phys. Rev.*, 1st/15th May 1946, Vol. 69, Nos. 9/10, p. 534.)

535.371.07 : 537.531 **3302**

Microsecond Phosphorescent Decay Periods of X-Ray Fluorescent Screens.—F. Marshall. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 114.) Abstract of an Amer. Phys. Soc. paper.

535.376 **3303**

Cathodo-Luminescence: Part I—Growth and Decay Processes: Part 2—Current Saturation and Voltage Effects: Part 3—Discussion of Results.—Strange & Henderson. (*See* 3240.)

537.226 **3304**

Dielectric Properties of Dipolar Solids.—H. Fröhlich. (*Proc. roy. Soc. A*, 5th April 1946, Vol. 185, No. 1003, pp. 399–414.) "A quantitative theory of the dielectric properties of crystalline solids consisting of dipolar long-chain molecules is developed (one dipole per molecule). In these solids the dipoles are concentrated in dipolar planes. In the ground state the dipolar planes have a permanent polarization, but usually the polarizations of successive planes have opposite directions. The static dielectric constant rises with increasing temperature up to a critical temperature T_0 and then decreases. At T_0 the substance has a phase transition of the second kind. Comparison with experiments by Muller on a solid ketone leads to good agreement.

"For chains with an even number of C-atoms metastable states with a permanent polarization are predicted, and a method to reach these states is discussed.

"The interaction between dipoles plays a predominant role at temperatures below T_0. It is shown that Lorentz's or Onsager's methods are invalid in this temperature range."

539.23 : 546.74 **3305**

Resistivity of Thin Nickel Films at Low Temperatures.—A. van Itterbeek & L. De Greve. (*Nature, Lond.*, 20th July 1946, Vol. 158, No. 4003, pp. 100–101.) As films thicker than 40 mμ cool towards liquid helium temperatures, the resistance passes through a minimum, the temperature at which this minimum occurs being higher the more nearly the thickness approaches to 40 mμ.

539.234 : 535.87 **3306**

Thermally Evaporated Anti-Reflexion Films.—S. Bateson & A. J. Bachmeier. (*Nature, Lond.*, 27th July 1946, Vol. 158, No. 4004, pp. 133–134.) The hardness of magnesium-fluoride films on glass is improved by vacuum-baking in preference to air-baking, and depends on the type of source and the degassing procedure. It is not affected by length of baking time. Soft coatings are caused by "soft fluoride", *i.e.* low-velocity molecules, and may be eliminated by use of faster pumps and special pellet sources. A similar effect is observed when coating on two surfaces. See also 2598 of September (Bannon).

541.64 + 679.5] : 05 **3307**

Journal of Polymer Science.—(*Nature, Lond.*, 13th April 1946, Vol. 157, No. 3989, p. 475.) Publication of new journal of high-polymer research.

546.23 **3308**

Volume, Internal Energy, and Entropy of Amorphous and Crystalline Selenium.—G. Borelius & K. A. Paulson. (*Ark. Mat. Astr. Fys.*, 26th Aug. 1946, Vol. 33, Part 1, Section A, No. 7, 16 pp. In English.) The values of these quantities and their differences ΔV, ΔU, ΔS, for the two forms of selenium are calculated from new determinations of the thermal expansion α and the heat capacity C. There are no real pre-melting phenomena in selenium, and in the glassy state (below 300°K) α and C have nearly the same values for the amorphous and crystalline forms; it is therefore concluded that "the values of ΔV, ΔU and ΔS obtained in the range of the supercooled liquid from 300 to 494°K are only dependent on the arrangement of the atoms in the liquid, which, at each temperature, attains a state of instable equilibrium." These difference values should be of use for testing theories of the structure of the liquid state. For previous work see 3637 & 3638 of 1945 (Borelius *et al.* & Weibull).

549.514.1 **3309**

Elastic Deficiency and Color of Natural Smoky Quartz.—C. Frondel. (*Phys. Rev.*, 1st/15th May 1946, Vol. 69, Nos. 9/10, pp. 543–544.) An account of experiments on the effect of various types of radiation on the elastic properties of quartz indicated by changes in the frequency of piezoelectric oscillation. The radiation produces an exponential fall in frequency to a saturation value, accompanied by a smoky coloration proportional to the change in frequency. Natural smoky quartz possesses a similar elastic deficiency which can be removed, together with the coloration, by baking. The effect, which is of the order of 0.01% of frequency, may be repeated reversibly by successive irradiation and baking. These results are relevant to the ascription of the origin of smoky quartz to natural radioactive radiation, but the effects of the artificial and presumed natural radiation differ in some respects. For instance natural smoky specimens have much smaller elastic deficiency in relation to the coloration than those irradiated artificially.

549.514.1 **3310**

The Breaking up of Single Crystals of Quartz.—D. D'Eustachio & S. B. Brody. (*Phys. Rev.*, 1st/15th March 1946, Vol. 69, Nos. 5/6, p. 256.) Quartz wafers prepared by etching from wafers 75–100 μ thick are found no longer to be single crystals when they become thinner than 25 μ. Abstract of an Amer. Phys. Soc. paper.

549.514.1 **3311**

Thermal Recrystallization of Quartz.—D. D'Eustachio & S. Greenwald. (*Phys. Rev.*, 1st/15th May 1946, Vol. 69, Nos. 9/10, pp. 532–533.) A further report on quartz wafers, 25–30 μ thick, which, though prepared from single crystals, are no longer single crystals themselves. The wafers are polycrystalline, neighbouring crystals being disoriented by one or two degrees. The single crystalline condition may be recovered by heating, and return to the polycrystalline state occurs if the specimen is bent a number of times round a cylindrical rod.

For previous work see 3310 above (D'Eustachio & Brody).

549.514.1 **3312**

Preparation of Synthetic Quartz.—N. Wooster & W. A. Wooster. (*Nature, Lond.*, 9th March 1946, Vol. 157, No. 3984, p. 297.) Spezia's method has been confirmed but found unsuitable for industrial production. In a new method, perfect but small crystals are produced by heating fused silica in a solution of sodium metasilicate.

621.314.2 : 621.395 : 621.316.974 **3313**

The Magnetic Screening of Telephone Transformers.—Nucci. (*See* 3429.)

621.314.632 : 546.289 **3314**

The Photo-Diode and Photo-Peak Characteristics in Germanium.—S. Benzer. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 105.) When certain germanium crystals are touched with a metal point, the saturation current depends on the illumination level and temperature. The maximum photo-effect occurs at about 1.3 μ, while for white light the sensitivity is several mA/lumen. The peak in the current/voltage characteristic may be eliminated by raising the temperature or level of illumination sufficiently; this behaviour is reversible, and may be applied in the design of a trigger photo-cell.

Abstract of an Amer. Phys. Soc. paper.

621.315.58.029.54/.64 **3315**

The Electrical Properties of Salt-Water Solutions over the Frequency Range 1-4 000 Mc/s.—R. Cooper. (*J. Instn elect. Engrs*, Part I, Aug. 1946, Vol. 93, No. 68, p. 358.) Long summary of 1880 of July.

621.315.59 **3316**

The Energy of Impurity Levels in Semi-Conductors.—B. Serin. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 104.) Abstract of an Amer. Phys. Soc. paper.

621.315.61 + 537.226 **3317**

Dielectrics in Theory and Application.—(*Nature, Lond.*, 27th July 1946, Vol. 158, No. 4004, pp. 121–124.) A report of discussions at meetings of the Royal Institute of Chemistry with the Institute of Physics, and of the Faraday Society. The former surveyed the fields of physical theory, chemical preparation and industrial applications; the latter dealt with surveys and original papers on the present state and immediate trends of physical-chemical and physical research. Two important contributions were concerned with the theory of the internal field of dielectrics, and with advances in h.f. dielectric measurements.

621.315.612 **3318**

Ceramic Dielectrics.—D. C. Swanson. (*Phys. Rev.*, 1st/15th May 1946, Vol. 69, Nos. 9/10, p. 546.) A study of the dielectric properties of certain ceramic alloys having dielectric constants of several thousand and resistivities of 10^6–10^{15} Ω . cm. The materials show marked changes in electrical properties with change of temperature and applied voltage. Proper choice of the alloys will give almost any desired electrical property.

Abstract of an Amer. Phys. Soc. paper.

621.315.612.4 **3319**

Dielectric Constants of Some Titanates.—P. R. Coursey & K. G. Brand. (*Nature, Lond.*, 9th March 1946, Vol. 157, No. 3984, pp. 297–298.) Addition of metallic titanates to a ceramic mix raises the permittivity to peak values as high as 44 000 at a temperature which is characteristic of the material. Solid solutions of two or more titanates exhibit similar properties, a mixture of two showing a linear relation between composition and the temperature of peak permittivity. Capacitors with positive or negative temperature coefficients of capacitance may be constructed with these dielectrics.

621.315.618.2.015.5 : 621.3.029.64 **3320**

Lowering of Electrical Breakdown Field Strength at Microwave Frequencies due to Externally-Applied Magnetic Field.—D. Q. Posin. (*Phys. Rev.*, 1st/15th May 1946, Vol. 69, Nos. 9/10, p. 541.) Studies of 3-cm microwave breakdown of air gaps in a waveguide reveal the following effects. (1) A gap on the verge of sparking can be made to spark over by the approach of a permanent magnet. (2) A magnet with small pole face may produce a 20% decrease in the breakdown field strength. (3) A magnet moved rapidly near the gap may lower the breakdown field strength by a factor of 2 or more. (4) No effect is produced by a magnetic field at right angles to the microwave electric vector. (5) Effects (2) and (3) are much diminished when broadface magnets are used. Various possible explanations of the effects are mentioned, but none appears entirely adequate.

621.316.842 + 621.315.553 **3321**

Resistance Materials for Standard Resistors.—A. Schulze. (*Arch. tech. Messen*, April 1940, No. 106, pp. T46–48.) Survey of electrical, thermal, and mechanical properties of manganin, isabellin (Cu-Mn alloy with Al) and novokonstant (Cu-Mn alloy with Al, Fe). Recommended technique for the construction of standard-resistance windings is described.

621.319.7 : 621.385 **3322**

Potentiograms and Electron Trajectories in Electrostatic Fields.—A. Pinciroli & M. Panetti.

Alta Frequenza, March/June 1945, Vol. 14, Nos. 1/2, pp. 81–95. With English, French and German summaries.) A general review of methods for plotting electrostatic fields is given. The electrolytic tank is considered in detail, with an examination of the sources of error. Experimental results for structures typical of valve electrode systems are described.

621.357.7 : 546.97 **3323**

Purification of Rhodium Plating Baths.—(*J. Franklin Inst.*, July 1946, Vol. 242, No. 1, pp. 64–65.) A note from the National Bureau of Standards on the impurities in rhodium phosphate plating baths that cause imperfect coatings. The addition of potassium ferrocyanide will precipitate the impurities which can then be filtered out.

621.793 : 546.74 **3324**

Nickel Plating on Steel by Chemical Reduction.—(*J. Franklin Inst.*, July 1946, Vol. 242, No. 1, p. 64.) A short note from the National Bureau of Standards. " The deposition is brought about by the chemical reduction of a solution of a nickel salt with hypophosphites. The reaction is catalyzed by steel and nickel, and deposition of nickel occurs only on the surfaces of these metals."

621.396.6 (213) **3325**

Deterioration of Radio Equipment in Damp Tropical Climates and Some Measures of Prevention.—Healy. (*See* 3502.)

666.3 + 621.315.612 **3326**

The Scientific Basis of Modern Applications of Ceramic Raw Materials.—W. Steger. (*Chalmers tekn. Högsk. Handl.*, 1944, No. 32, 23 pp. In German.) A brief survey of the composition and properties of ceramics in use for technical applications, with some indication of process of manufacture. The materials considered are :—(1) Systems with one component : silicic acid, aluminium oxide, alkaline earth oxides, other highly refractory oxides, titanium dioxide ; (2) Binary systems : silicic acid–aluminium oxide, silicic acid–alkaline earth oxides, other simple silicates, non-silicate oxide systems ; (3) Ternary systems : silicic acid–aluminium oxide–alkali oxides, silicic acid–aluminium oxide–alkaline earth oxides.

666.3 **3327**

The Evolution of Ceramic Technique in the Laboratories of the Compagnie Générale de Télégraphie sans Fil (C.S.F.). C.S.F. Processes for the Preparation of High Precision Ceramics.—F. Violet & R. Lecuir. (*Ann. Radioélect.*, Oct. 1945 & Jan. 1946, Vol. 1, Nos 2 & 3, pp. 152–159 & 242–255.)

MATHEMATICS

512.37 **3328**

Approximating Formulae.—W. Luchsinger. (*Brown Boveri Rev.*, July 1945, Vol. 32, No. 7, pp. 238–242.) Simple explanation of methods of fitting algebraic curves to experimentally determined data.

517.432 **3329**

The Steady-State Operational Calculus.—D. L. Waidelich : N. F. Riordan. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1946, Vol. 34, No. 8, pp. 579–580.) Discussion of 1276 of May (Waidelich).

517.942 **3330**

On Stokes Functions.—P. G. Bordoni. (*Alta Frequenza*, Sept./Dec. 1945, Vol. 14, Nos. 3/4, p. 227.) Abstract of a paper from *Commentationes Pont. Acad. Sci., Vatican City*, 1945, Vol. 9, No. 3, pp. 87–113, which includes tables and graphs of the 1st, 2nd and 3rd order functions useful in acoustical problems.

518.2 **3331**

Integration of $\sin^2 x$ dx/x.—S. M. Christian. (*Phys. Rev.*, 1st/15th May 1946, Vol. 69, Nos. 9/10, p. 546.) Notice of the preparation of table of values of the definite integral, from 0 to x. Typical values are given for x in the range 0.5 to 11.

Abstract of an Amer. Phys. Soc. paper.

518.3 **3332**

Nomograph Construction : Part 2—Charts with Complicating Factors or Constants.—F. Shunaman. (*Radio Craft*, July 1946, Vol. 17, No. 10, pp. 690..719.) For part 1 see 2830 of October.

518.5 **3333**

An Improved Slide Rule for the Addition of Squares.—B. H. Dawson. (*Science*, 5th July 1946, Vol. 104, No. 2688, p. 18.) A modification of Morrell's method (2616 of September) using a pair of scales instead of a single scale. See also 2956 of October (Dempster).

518.61 **3334**

On a New Method of Approximate Integration of Second Order Differential Equations.—F. Rabinovitch. (*Ann. Radioélect.*, Oct. 1945, Vol. 1, No. 2, pp. 134–151.) " This method, based on extrapolation, is a generalized extension of Adams' method for equations of the first order. It embraces as particular cases most of the classical methods of approximate integration, notably Störmer's. The new method is applied to the equation $d^2x/dt^2 = f(x) \sin t$ occurring in the study of the motion of a particle in an oscillating field of force. Formulae for approximate integration, and estimates of the resulting errors are given.

" The treatment concludes with a comparison of the new method and Störmer's for some numerical cases related to the problem of electron motion in a non-uniform h.f. field."

Corrections are given in *Ann. Radioélect.*, Jan. 1946, Vol. 1, No. 3, p. 276.

519.283 : 53.08 **3335**

Experimental Data and ' Sufficient ' Accuracy.—H. A. Hughes. (*Nature, Lond.*, 6th July 1946, Vol. 158, No. 4001, p. 29.) Using the formula $\alpha = 0.6745 \sqrt{[\Sigma(x_n - M)^2/n(n-1)]}$ to obtain the most probable error α of the arithmetic mean of a series of n distance-measurements $x_1 \ldots x_n$, it was found that at least 7 observations were necessary to get M to within 2% in one case. 10 was regarded as a safer minimum in general.

519.283 : 621.318.572 **3336**

On the Statistical Treatment of Counting Experiments in Nuclear Physics.—N. Hole. (*Ark. Mat. Astr. Fys.*, 30th Aug. 1946, Vol. 33, Part 2, Section A, No. 11, 11 pp. In English.) Formulae are developed for the statistical distribution of the time intervals between impulses observed on counting apparatus, and the influence of the recovery time (" resolving power ") of the counter is considered theoretically. The case of a pair of counters in cascade is also treated.

51 (075) : 62 **3337**

Engineering Mathematics. [Book Review]—H. Sohon. Van Nostrand Co., New York, 1944. (*J. appl. Phys.*, June 1946, Vol. 17, No. 6, p. 536.) The book " is intended to strengthen the student in algebra and to provide him with certain mathematical tools which depend on the calculus." See also 2236 of August.

51(075) : 621.396 **3338**

Basic Mathematics for Radio Students. [Book Review]—F. M. Colebrook. Iliffe, London, 270 pp., 10s. 6d. (*Nature, Lond.*, 24th Aug. 1946, Vol. 158, No. 4008, p. 254; *R.S.G.B. Bull.*, Sept. 1946, Vol. 22, No. 3, p. 45; *Elect. Rev., Lond.*, 26th July 1946, Vol. 139, No. 3583, p. 144.) "[The author] has rendered a valuable service to students and engineers alike . . ." ". . . a substantial gap in the literature for teaching potential engineers has been filled."

518.2 : 016 **3339**

An Index of Mathematical Tables. [Book Review]—A. Fletcher, J. C. P. Miller & L. Rosenhead. Scientific Computing Service, London, 451 pp., 75s. (*Elect. Rev., Lond.*, 6th Sept. 1946, Vol. 139, No. 3589, p. 388. *Proc. phys. Soc.*, 1st July 1946, Vol. 58, No. 328, pp. 491–492.) Aim is to provide "a working tool for the working scientist in a wide variety of investigations".

519.2(075.8) **3340**

Elementary Statistics. [Book Review]—H. Levy & E. E. Preidel. Ronald Press Co., New York, 1945, 184 pp., $2.25. (*J. appl. Phys.*, June 1946, Vol. 17, No. 6, pp. 535–536.) ". . . an introduction to more advanced texts, and, as such, should contribute to the growing use of statistical methods."

MEASUREMENTS AND TEST GEAR

53.081 **3341**

A Discussion on Units and Standards.—(*Proc. roy. Soc. A*, 9th July 1946, Vol. 186, No. 1005, pp. 149–217.) A symposium of short papers by staff of the National Physical Laboratory, on units and standards studied at the Laboratory. Each paper gives the main technical details and a short history.

621.316.842 + 621.315.553 **3342**

Resistance Materials for Standard Resistors.—Schulze. (*See* 3321.)

621.317.083.7 **3343**

Telemetering Equipments for the Transmission of Any Desired Measurements over Long Distances.—F. Jaggi. (*Brown Boveri Rev.*, April 1945, Vol. 32, No. 4, pp. 147–148.) A short account of a system using a variable audio frequency for remote indication.

621.317.1.011.5 + 621.396.11.029.64 + 535.343.4] : 546.171.1 **3344**

The Inversion Spectrum of Ammonia.—Good. (*See* 3236.)

621.317.333.4 **3345**

Two Methods of Localising Cable Faults.—J. M. Allan. (*P.O. elect. Engrs' J.*, July 1946, Vol. 39, Part 2, pp. 70–72.) A modification of the Varley test which nullifies the disturbing effects of varying induced currents, and a method of testing when no good wire is available.

621.317.334/.335] : 621.315.2 **3346**

Measurement of Inductance and Capacitance of Conductors and Cables.—O. Naumann. (*Arch. tech. Messen*, June 1940, No. 108, pp. T63–65.) Survey of d.c. methods of measurement (Thomson comparison method, "shared charge" method, Sauty bridge), and of l.f. methods (Wheatstone bridge, Maxwell bridge, Geyger's compensation circuit, Wien and Wien-Wagner bridge and its derivatives, Felten and Guilleaume's impedance bridge).

621.317.39 : 535.34 **3347**

The Measurement of Nuclear Spin, Magnetic Moment, and Hyperfine Structure Separation by a Microwave Frequency-Modulation Method.—A. Roberts, Y. Beers & A. G. Hill. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 112.) Abstract of an Amer. Phys. Soc. paper.

621.317.39.029.64 : 537.312.62 : 546.815–1 **3348**

Superconductivity of Lead at 3-Cm Wave-Length.—Bitter, Garrison, Halpern, Maxwell, Slater & Square. (*See* 3258.)

621.317.4 **3349**

Some Uses of the Magnetic Potentiometer for the Determination of Magnetization Curves upon Open-Circuited Specimens.—T. A. Margerison & W. Sucksmith. (*J. sci. Instrum.*, Aug. 1946, Vol. 23, No. 8, pp. 182–184.)

621.317.71/.72] : 621.314.632 **3350**

Moving Coil Rectifier Instruments for A.C. Measurements: Part 1—Equivalent Circuit Diagram and Temperature Errors: Part 2—Frequency Error, Back-Current Error, Ageing Error and Waveform Error.—K. Maier. (*Arch. tech. Messen*, May & June 1940, Nos. 107 & 108, pp. T57 & T69–70.)

621.317.7 **3351**

Electrical Measuring Instruments.—F. E. J. Ockenden & D. C. Gall. (*J. Instn elect. Engrs*, Part I, Aug. 1946, Vol. 93, No. 68, pp. 348–354.) A review of progress during the past decade, discussing the design and construction of industrial instruments and the wide applications of electrical and electronic instruments to scientific measurement.

621.317.725 **3352**

An Electrostatic Generating Voltmeter for Measurement of Very Small E.M.Fs.—S. A. Scherbatskoy & R. E. Fearon. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 96.) Short notes describing a null instrument having good long-term zero-stability and "nearly complete immunity to mechanical or thermal abuse". Ionization currents of as low as 10^{-19} ampere "or better" can be measured.

621.317.75.087.5 : 522.5 **3353**

On the Registration of the Exact Time of Each Exposure by Cinematographic Photography.—K. G. Malmquist, H. Norinder & W. Stoffregen. (*Ark. Mat. Astr. Fys.*, 26th Aug. 1946, Vol. 33, Part 1, Section B, No. 3, 7 pp. In English.) The exact time of exposure of film is measured by means of a double c.r. tube. The method is of use for solar eclipse observations.

621.317.761 **3354**

A Standard-Frequency Generator for High-Precision Measurements.—M. Boella. (*Alta Frequenza*, Sept./Dec. 1945, Vol. 14, Nos. 3/4, pp. 183–194. With English, French, and German summaries.) A laboratory equipment based on a quartz oscillator at 100 kc/s giving a series of over 55 000 single standard frequencies between 10 kc/s and 30 Mc/s. The interval in this range varies from 3 kc/s at the high-frequency end to 2 c/s at the low end. With an interpolating low-frequency meter the measurement of a radio frequency can be carried out to a precision not less than 10^4 times that of the interpolator.

621.317.79 **3355**

Constructing a Grid Dip Meter.—H. Burgess. (*Radio News*, Aug. 1946, Vol. 36, No. 2, pp. 50–51.) Constructional details of a test instrument comprising a variable-frequency oscillator with a mixer tube, and with a milliammeter connected in its grid lead. It can be used as a simple signal generator or frequency meter.

621.317.79 : 621.385.1 **3356**

Tube Checker Modernizer.—H. A. Foster. (*Radio Craft*, Aug. 1946, Vol. 17, No. 11, pp. 753 . . . 803.) Constructional details of an additional panel which may be added to an existing valve tester to make it suitable for testing modern valves.

621.317.79 : 621.396.621 **3357**

Output Systems of Signal Generators.—A. Peterson. (*Gen. Radio Exp.*, June 1946, Vol. 21, No. 1, pp. 1–8.) Discussion of errors in measurement, particularly at frequencies of 5–30 Mc/s, due to the form of the output circuit and lead. Four arrangements are considered analytically in which the line is either (*a*) matched at both ends, (*b*) matched at the generator end, (*c*) matched at the load end, or (*d*) unmatched. The output e.m.f. and impedance are presented in graphical form as a function of frequency.

621.317.79 : 621.396.621 **3358**

The Transigenerator.—R. E. Altomare. (*Radio Craft*, July 1946, Vol. 17, No. 10, pp. 686 . . 722.) Constructional details of a simple transitron signal generator for the range 160 kc/s–8 Mc/s.

621.392 **3359**

The Relation between Nodal Positions and Standing Wave Ratio in a Composite Transmission System.—Feenberg. (*See* 3175.)

621.392 : 621.317.33.029.64 **3360**

The Use of the Impedance Concept as Applied to Wave Guides.—Williams & Bolton. (*See* 3178.)

621.396.24.029.63 **3361**

Development Work in the Decimetre Wave Field.—R. Schüpbach & A. de Quervain. (*Brown Boveri Rev.*, Sept. 1944, Vol. 31, No. 9, pp. 292–295.) A general discussion of measurement techniques and screening, and a description of cavity-resonator couplings. Curves are given for a filter consisting of two inductively coupled resonators which are damped to give a Q of 350 and a coupling factor of 0.51%.

621.396.611.21 : 529.786 **3362**

A Quartz Clock.—Booth. (*See* 3388.)

621.396.611.21 : 621.396.615 **3363**

A 100 kc/s Quartz Frequency Sub-Standard and Harmonic Generator.—E. W. Nield. (*R.S.G.B. Bull.*, Sept. 1946, Vol. 22, No. 3, pp. 39–40.) An LC circuit tuned to the resonant frequency of the crystal is placed in series with the latter; this arrangement effectively cancels stray reactances which might otherwise impair stability. A 50% change of supply voltage produces a fundamental frequency change of only a fraction of a cycle per second.

621.397.79 : 621.396.621 **3364**

Tracer Plus Power Supply.—W. H. Watkins. (*Radio Craft*, Aug. 1946, Vol. 17, No. 11, pp. 756 . . 791.) Wiring diagram and constructional details of an equipment suitable for servicing tests at r.f., i.f. and a.f. on radio receivers and sound equipment.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

518.5 : 621.3 **3365**

Computation Problems in Circuit Design.—G. T. Baker. (*P.O. elect. Engrs' J.*, July 1946, Vol. 39, Part 2, pp. 58–63.) The fundamental processes of computation, when numbers are expressed on the binary scale, may be represented physically by the action of a simple two-position relay. Circuits are given which perform these operations, with extension to the decimal scale. The technique is illustrated by an application to time-measurement problems.

621.317.083.7 **3366**

Telemetering Equipments for the Transmission of Any Desired Measurements over Long Distances.—Jaggi. (*See* 3343.)

621.317.39 : 537.221 : 544.8 : 669.018 **3367**

Sorting Alloys.—N. F. Agnew. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 124–125.) Short description, with a circuit diagram, of a device for the non-destructive identification of alloys. A piece of standard metal is rubbed against the metal to be tested, and the resulting triboelectric voltage is measured. The instrument is calibrated by reference to materials of known composition.

621.317.39 : 620.172.222 **3368**

The Electrical Measurement of Strain.—S. C. Redshaw. (*J. R. aero. Soc.*, Aug. 1946, Vol. 50, No. 428, pp. 568–602. Discussion, pp. 603–612.) Description of strain gauges in which mechanical strains produce variations in electrical parameters. Resistance-type gauges consisting of fine wire mounted on slips of paper cemented to specimens under test are found to be of most general use.

621.317.39 : 621.753.3 **3369**

Capacitive Micrometer.—R. W. Dayton & G. M. Foley. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 106–111.) The principle used is that the change in capacitance between an electrode and the specimen examined is used to change the frequency of an oscillator, and hence, by means of a discriminator following a frequency converter and amplifier, to produce a proportional voltage for driving an indicator. Circuit diagrams of two such devices are given, and applications to the measurement of lathe-spindle movement and to dilatometers, manometers, roughness gauges, and hardness testers are described briefly. Design considerations and limits to the technique are discussed. Performance characteristics of typical instruments are given in tables. See also 2991 of October (Hayman), and 3370 below (Foley).

621.317.39 : 621.753.3 : 621.941 **3370**

Testing of Precision-Lathe Spindles.—G. M. Foley. (*Trans. Amer. Soc. mech. Engrs*, Oct. 1945, Vol. 67, No. 7, pp. 553–556.) An account of an application of the equipment described in 3369 above (Dayton & Foley).

621.317.39.083.7 + 621.316.7] : [533.275 + 536.5 **3371**

Recorder - Controller for Temperature and Humidity.—V. D. Hauck, R. E. Sturm & R. B. Colt. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 96–99.) Temperature is indicated by a temperature-sensitive resistor, and humidity by means of a hair hygrometer that controls the position of a contact on a resistor. The recorder (of which a simplified circuit diagram is given) scans eight pairs of remote measuring units every fifteen minutes. The resistors in each unit control a recorder or humidity-control devices through a self-balancing bridge. A general technical description of the device is given.

621.317.39.087.4 : 533.275 **3372**

Humidity Recording.—P. E. Maier. (*Electronic Industr.*, July 1946, Vol. 5, No. 7, pp. 70..102.) Description of an equipment for continuously recording the relative humidity of a gas. A dew-point mirror on a copper tube is observed with a photocell. When no dew is present, relays cause cooling water to flow in the tube and the flow stops when the dew forms. The temperature of the tube therefore hunts, with the dew point as maximum. The temperatures of the pipe and of the gas are measured with resistance thermometers that are connected in a circuit arranged to combine the readings to give the value of the relative humidity on a recording ohmmeter.

621.317.755 : 535.33 : 535.61–15 **3373**

"Instantaneous" Presentation of Infra-Red Spectra on a Cathode Ray Screen.—E. F. Daly & G. B. B. M. Sutherland. (*Nature, Lond.*, 27th April 1946, Vol. 157, No. 3991, p. 547.) The radiation is interrupted at 15–20 c/s, and falls on a thermistor bolometer after passing through the spectrometer. The output of the bolometer bridge is amplified, rectified, and applied to the Y plates. X-plate deflexion is associated with the frequency scan. See also 3374 below (King, Temple & Thompson).

621.317.755 : 535.33 : 535.61–15 **3374**

Infra-Red Recording with the Cathode Ray Oscilloscope.—J. King, R. B. Temple & H. W. Thompson. (*Nature, Lond.*, 10th Aug. 1946, Vol. 158, No. 4006, pp. 196–197.) Brief description of an equipment similar to that used in 3373 above (Daly & Sutherland).

621.365.5 **3375**

Medium Frequency Power in Industry.—H. Fehlmann & V. Widmer. (*Brown Boveri Rev.*, May 1944, Vol. 31, No. 5, pp. 159–162.) Brief account of the consideration of an induction furnace plant, with considerations on the design of unipolar generators, for operation in the range 250–10 000 c/s.

621.365.92 **3376**

Basic Factors in Dielectric Heating : Part 1.—E. S. Winlund. (*Elect. World, N.Y.*, 3rd Aug. 1946, Vol. 126, No. 5, p. 80.) Formulae, with numerical examples, relating minimum heating time, transfer efficiency, and required power, to the nature and thickness of the material to be heated and to generator frequency. First of three articles.

621.365.92 **3377**

Dielectric Heating.—A. J. Maddock. (*J. sci. Instrum.*, Aug. 1946, Vol. 23, No. 8, pp. 165–173.) A general review of the subject, including an outline of the theory and an account of useful applications.

621.38 : 6 **3378**

Industrial Electronics.—(*Engineer, Lond.*, 19th July 1946, Vol. 182, No. 4723, pp. 54–55.) Some examples of thyratron and ignitron control devices shown at the British Thomson-Houston symposium. Particular attention is paid to motor control, voltage regulation, and resistance welding. For another account see *Engineering, Lond.*, 19th July 1946, Vol. 162, No. 4201, p. 68.

621.383 : 621.316.578 : 628.971.6 **3379**

Photoelectric Street Lighting Control.—C. E. Marshall. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 134–136.) Description, with circuit diagrams, of a device for switching the lights according to the local degree of darkness. Features such as proper selection of time delays and operating thresholds are discussed in some detail.

621.385.833 + 537.533.72 **3380**

The Variation of Resolution with Voltage in the Magnetic Electron Microscope.—Cosslett. (*See* 3245.)

621.385.833 + 537.533.72 **3381**

A Study of Distortion in Electron Microscope Projection Lenses.—J. Hillier. (*J. appl. Phys.*, June 1946, Vol. 17, No. 6, pp. 411–419.) "The origin of distortion . . . is discussed and the serious nature of its effect on the measurement of particle size distributions is pointed out. Methods of measuring distortion are described. By means of first-order theory it is shown to be possible to correct distortion by the use of a two-element projection lens. The degree of correction obtainable is shown to be satisfactory for most practical purposes. A double-gap projection lens polepiece and the correction of distortion obtained with it are described."

621.385.833 + 537.533.72 **3382**

A Zonally Corrected Electron Lens.—D. Gabor. (*Nature, Lond.*, 10th Aug. 1946, Vol. 158, No. 4006, p. 198.) A new type of lens to reduce spherical aberration in an electron microscope, uses a central wire surrounded by several annular electrodes. It is unsuitable as a microscope objective, but may be used to correct objectives. This lens also reduces depth of focus and may be useful for exploring objects in depth.

621.385.833 **3383**

Some Recent Developments in the Field of Electron Microscopy.—R. W. G. Wyckoff. (*Science*, 12th July 1946, Vol. 104, No. 2689, pp. 21–26.) An account of the present position and future possibilities of electron microscopy for the examination of tissues, surface structure, and organisms of interest in bacteriology.

621.385.833 **3384**

Electron Optics and Its Application to the Electron Microscope.—P. Chanson. (*Onde élect.*, March 1946, Vol. 26, No. 228, pp. 95–100.) A description of the general theory, with particular reference to the wave interpretation of high-speed electrons. The author concludes with a short note on the present advanced state of development of this subject in France. In particular, work at the Collège de France is pointing the way to a "proton microscope", with the possibility of magnifications up to 400 000 (see 2659 of September—Magnan, Chanson & Ertaud).

621.385.833 **3385**

Contour Fringes and Asymmetries of Electron Microscope Objectives.—J. Hillier & E. G. Ramberg. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 113.) Abstract of an Amer. Phys. Soc. paper.

621.385.833 **3386**

Modifications of Specimens in Electron Microscopy.—L. Marton, N. N. Das Gupta & C. Marton. (*Science*, 12th July 1946, Vol. 104, No. 2689, pp. 35–36.) Stresses the necessity for obtaining independent evidence on the stability of specimens under examination.

621.385.833 **3387**

Frozen-Dried Preparations for the Electron Microscope.—R. W. G. Wyckoff. (*Science*, 12th July 1946, Vol. 104, No. 2689, pp. 36–37.) A method of preparation for obtaining specimens without distortion or shrinkage.

621.396.611.21 : 529.786 **3388**

A Quartz Clock.—C. F. Booth. (*P.O. elect. Engrs' J.*, July 1946, Vol. 39, Part 2, pp. 33–37.) A general description of the principles, with details of equipment being produced by the British Post Office for the Royal Observatory.

621.396.931 **3389**

New Radio Warning Device tested by Chicago & North Western.—(*Telegr. Teleph. Age*, Aug. 1946, Vol. 64, No. 8, pp. 26, 27.) Note on a new "slow-tone" device, for use on trains, which broadcasts a series of high-pitched notes at four-second intervals, allowing voice communication at the same time.

623.26 : 621.396.9 **3390**

How Mine Detectors Work.—E. Leslie. (*Radio Craft*, July 1946, Vol. 17, No. 10, pp. 676 . . 721.) General description, with circuit diagrams, of one a.f. mutual-inductance type for detecting metallic mines.

786.6 : 621.383 **3391**

Photoelectric Tone Generator.—L. E. Greenlee. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 93–95.) An account of the device described in 2668 of September (Campbell & Greenlee).

PROPAGATION OF WAVES

523.78 : [551.51.053.5 + 621.396.11 **3392**

The Solar Eclipse of 1945 and the Propagation of Radio Waves.—R. L. Smith-Rose. (*Alta Frequenza*, March 1946, Vol. 15, No. 1, pp. 37–38.) Long summary in Italian of 1831 of July.

537.56 : 621.396.11 **3393**

Conduction and Dispersion of Ionized Gases at High Frequencies.—Margenau. (*See* 3246.)

621.396.11 **3394**

Study of the Propagation of Electromagnetic Waves in Mountains, Valleys, Fiords, etc.—B. Polié. (*Onde élect.*, March 1946, Vol. 26, No. 228, p. 7A.) Abstract of a paper appearing in *T.S.F. Technik*, April 1944, Vol. 33, No. 4, and in *J. Télécomm.*, May 1945, Vol. 7, No. 5, pp. 57–62. Vilbig has suggested that a valley acts as a waveguide, only propagating waves below a critical wavelength. The author has tested the theory with sheet-iron models (scale about 1 : 500) at wavelengths 0.8–4 m. There was a cut-off wavelength equal to twice the valley width except for polarization normal to the valley wall, when there was no cut off, but appreciable attenuation at all wavelengths.

621.396.11 : 551.51.053.5 **3395**

The Ionosphere and Short-Wave Broadcasting.—T. W. Bennington. (*B.B.C. Quart.*, April 1946, Vol. 1, No. 1, pp. 29–32.) An elementary survey.

621.396.11.029.6 : 546.21–1 **3396**

The Absorption of One-Half Centimeter Electromagnetic Waves in Oxygen.—R. Beringer. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, pp. 53–57.) "The apparatus employs a [1-cm] klystron oscillator, crystal-rectifier frequency-multiplier, wave guide absorption path, and crystal detector. The measured values [for oxygen and oxygen-nitrogen mixtures] are in agreement with the theory of Van Vleck [unpublished reports] both as regards the absolute value of the absorption . . . and the dependence on pressure." The sharp peak of the absorption curve occurs very close to 0.5 cm wavelength, and at the peak gives rise to attenuations (at normal pressure) of about 67 and 15 db/km for pure oxygen and air respectively.

621.396.11.029.64 : 535.343.4 **3397**

Expected Absorption in the Microwave Region by Water Vapor and Similar Molecules.—Hainer, King & Cross. (*See* 3235.)

RECEPTION

621.396.619.018.41 **3398**

Frequency Modulation : Part 3.—Courtillot. (*See* 3420.)

621.396.619.018.41 **3399**

The Mutual Effect of Two Frequency Modulated Waves in Limiters.—P. Güttinger. (*Brown Boveri Rev.*, Sept. 1944, Vol. 31, No. 9, pp. 296–297.) The frequency spectrum is calculated. It is shown that the audio frequency of only one transmitter remains. The audio frequency of the other transmitter and overtones and beat notes of the audio frequencies are absent. The disturbing element consists chiefly of beat notes due to the difference between the carrier frequencies and their harmonics.

621.396.621 + 621.396.61 **3400**

Inside the Handie-Talkie.—Scott. (*See* 3449).

621.396.621 **3401**

Some Radio Receiver Design Considerations.—P. P. Di Roberto. (*Alta Frequenza*, Sept./Dec. 1945, Vol. 14, Nos. 3/4, pp. 232–234.) Long summary of a paper in *Boll. Inform. Comp. Gen. Elett.*, April 1945, pp. 8–15.

621.396.621 **3402**

The Radio News Circuit Page.—(*Radio News*, Aug. 1946, Vol. 36, No. 2, pp. 64 . . 71.) For previous parts see 2680 of September.

621.396.621 **3403**

Radio Data Sheet 337.—(*Radio Craft*, July 1946, Vol. 17, No. 10, p. 691.) Servicing data for Emerson Radio Models 501, 502 and 504.

621.396.621 **3404**

Radio Data Sheet No. 338.—(*Radio Craft*, Aug. 1946, Vol. 17, No. 11, p. 762.) Servicing data for General Electric Model 250 receiver.

621.396.621 + 621.396.61].029.62 **3405**

Transmitter-Receiver for Ham Beginners : Part 1.—C. M. Sullivan. (*Radio News*, Aug. 1946, Vol. 36, No. 2, pp. 32 . . 140.) A description of the design and construction of a superregenerative receiver for use in the 144–148-Mc/s band. The audio-frequency section is used as the modulator of the transmitter.

621.396.621 + 621.396.61].029.63 **3406**

2 700 Mc/s Transceiver.—K. H. (*See* 3458.)

621.396.621.029.64 **3407**

Low Noise Microwave Video Receiver Design.—W. J. Zable. (*Radio, N.Y.*, July 1946, Vol. 30, No. 7, pp. 10 . . 32.) New design factors for a low-noise input circuit comprising a neutralized triode followed by a grounded-grid output tube are discussed. The analysis of a π network suitable for coupling to a crystal mixer is given.

621.396.621.54 **3408**

Practical Radio Course : Part 47.—A. A. Ghirardi. (*Radio News*, Aug. 1946, Vol. 36, No. 2, pp. 46 . . 111.) An account of multigrid mixers and converters. For previous parts see 2684 & 2692 of September and back references.

621.396.622.4.029.64 : 537.228.4 **3409**

Optical Microwave Detector.—P. H. Miller, Jr., & B. Goodman. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 110.) A proposed device in which plane-polarized monochromatic light is modulated in passing through a Kerr cell in a resonant cavity and through an analyser. The spacing of the sidebands so produced about the light frequency may be measured on an interferometer. The instrument is expected to have a sensitivity of 10^{-7} W, but means of improving this to 10^{-12} W are envisaged.

Abstract of an Amer. Phys. Soc. paper.

621.396.645 **3410**

Design of Broad Band I.F. Amplifiers.—Baum. (*See* 3223.)

621.396.822 **3411**

Statistical Analysis of Spontaneous Electrical Fluctuations.—R. Fürth & D. K. C. MacDonald. (*Nature, Lond.*, 15th June 1946, Vol. 157, No. 3998, p. 807.) A recently developed statistical theory of electrical fluctuations such as shot effect has been found to give good agreement with experimental results.

621.397.62 **3412**

Television Receivers.—Monfort. (*See* 3447.)

STATIONS AND COMMUNICATION SYSTEMS

621.396 : 061.5 **3413**

High-Frequency and Communications Engineering.—(*Brown Boveri Rev.*, Jan./Feb. 1945, Vol. 32, Nos. 1/2, pp. 73–77.) A brief review of progress and work of the Brown Boveri Company in 1944 with special mention of stability tests on sets designed for aircraft communication purposes.

621.396.2 **3414**

Mobile Relay Broadcasting.—H. E. Ennes. (*Radio, N.Y.*, July 1946, Vol. 30, No. 7, pp. 17–19, 30.) A pack transmitter is used at the scene of the broadcast. The transmission is picked up by a mobile unit and relayed to the nearest point that is linked to the studio by audio wire line. Detailed descriptions of the various equipments are given.

621.396.43 **3415**

Various Possible Applications for Beam Transmission.—R. Schüpbach. (*Brown Boveri Rev.*, Sept. 1944, Vol. 31, No. 9, pp. 288–291.) Graphs give the maximum elevation of the ground permissible for a communication link on 75-cm wavelength, and a radio-telephone link using frequency modulation is described.

621.396.44+621.392.2] : 551.574.7 **3416**

The Effect of Sleet on the Propagation of Carrier Waves along High-Voltage Transmission Lines.—A. Wertli. (*Brown Boveri Rev.*, Nov. 1944, Vol. 31, No. 11, pp. 362–366.) A short account of the experimental recording apparatus used on the Schwägalp-Säntis line together with photographs of the line and a typical record. No results are given.

621.396.44+621.398 **3417**

Carrier-Current Communication over High-Voltage Transmission Lines.—E. Hancess. (*Brown Boveri Rev.*, Oct. 1944, Vol. 31, No. 10, pp. 335–339.) An outline of a system for a 10-kV power line, with a description of the coupling units and protective devices, and a short consideration of the range and efficiency as limited by line noise and climatic conditions.

621.396.619.018.41 **3418**

Frequency Modulation.—P. Besson. (*Onde élect.*, June 1946, Vol. 26, No. 231, pp. 239–256.) Conclusion of 2703 of September. See also 3419 & 3420 below (Matricon : Courtillot).

621.396.619.018.41 **3419**

Frequency Modulation : Parts 1 & 2.—M. Matricon. (*Rev. tech. Comp. franç. Thomson-Houston*, Jan. 1944, No. 1, pp. 5–43.) An elementary survey dealing with general principles and the methods of generation of f.m. waves. For part 3 see 3420 below. See also 3418 above (Besson).

621.396.619.018.41 **3420**

Frequency Modulation : Part 3.—E. P. Courtillot. (*Rev. tech. Comp. franç. Thomson-Houston*, Oct. 1945, No. 4, pp. 3–24.) For parts 1 & 2 see 3419 above. This part deals with reception, including signal/noise ratio and distortion.

621.396.619.16 **3421**

Pulse Modulating System.—W. R. Greer. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 126–131.) Description of equipment similar to that described in 2315 of August (Kelleher) and back references.

621.396.712 **3422**

Studio Equipment : a New Design.—H. D. Ellis. (*B.B.C. Quart.*, April 1946, Vol. 1, No. 1, pp. 21–28.)

621.396.712.004.5 **3423**

Preventive Maintenance for Broadcast Stations.—C. H. Singer. (*Communications*, Aug. 1946, Vol. 26, No. 8, pp. 33, 54.) A discussion of the facilities required for routine upkeep work, with advice on safety precautions. Third of a series ; for previous parts see 3055 of October and 2709 of September.

621.396.931.029.62 **3424**

A Method of Increasing the Range of V.H.F. Communication Systems by Multi-Carrier Amplitude Modulation.—J. R. Brinkley. (*J. Instn elect. Engrs*, Part 1, Aug. 1946, Vol. 93, No. 68, pp. 360–362.) Summary of 2326 of August.

621.396.933 **3425**

Aviation Radio.—G. Newstead. (*Proc. Instn Radio Engrs, Aust.*, April 1946, Vol. 7, No. 4, pp. 3–19.) A survey of the factors affecting the choice of frequency bands, the spacing of ground stations for communication purposes, navigation aids, and ground station design, with special reference to Australian conditions. Consideration is given to the effects at various frequencies of atmospherics, precipitation and man-made static, and of the ionosphere. Graphs show the variation of field strength with distance and flying height.

A description is given of the U.S. Civil Aeronautics Administration v.h.f. (120 Mc/s) radio range which provides course indication on a pointer-type instrument with aural quadrant indication by the A-N system.

Problems discussed include operation of transmitters and receivers on sites remote from the airport and reception in proximity to the transmitter.

621.397.7 **3426**

A Plan for Television Studios.—P. Bax. (*B.B.C. Quart.*, July 1946, Vol. 1, No. 2, pp. 47–51.) The present studio arrangement at Alexandra Palace has several serious disadvantages. Improvements in design for a future station are discussed whereby the studios and the associated departments are arranged to form a segment of a circle, thus giving facilities for any subsequent expansion.

SUBSIDIARY APPARATUS

531.787 **3427**

An Accurate Bellows Manometer.—H. G. East & H. Kuhn. (*J. sci. Instrum.*, Aug. 1946, Vol. 23, No. 8, p. 185.) Description of an instrument in which the expansion and contraction of bellows is transmitted to an optical lever. Pressure differences at any absolute value from vacuum up to several atmospheres may be measured with a sensitivity of 5×10^{-4} mm Hg.

621.3.085.22 **3428**

Meter and Instrument Jewels and Pivots.—G. F. Shotter. (*J. Instn elect. Engrs*, Part I, June 1946, Vol. 93, No. 66, pp. 276–278.) Long abstract of paper published in *J. Instn elect. Engrs*, Part II, Feb. 1946, Vol. 93, No. 31. For another abstract see 2738 of 1945.

621.314.2 : 621.395 : 621.316.974 **3429**

The Magnetic Screening of Telephone Transformers.—P. Nucci. (*Alta Frequenza*, March/June 1945, Vol. 14, Nos. 1/2, pp. 11–80. With English, French and German summaries.) Screening for static and for l.f. fields is investigated theoretically for magnetic and non-magnetic materials. The screening effect is substantially independent of the shape and in some cases of the absolute dimensions of the screen; it increases linearly with screen permeability and with its thickness when this is small, and it also increases exponentially with the number of screens. The screening is expressed in terms of p = geometrical thickness/penetration depth. If $p \gg 1$ the screening varies as e^p.

Experiments on single and multiple screens are described with particular reference to disturbing fields from mains transformers. The screening effect follows the theoretical formulae qualitatively but is always smaller, probably due to uncertainty in the initial permeability and to decrease of the permeability with increasing frequency. The latter effect makes copper screens preferable above a certain frequency because of their higher conductivity.

Correction factors to the theoretical formulae are given, enabling the attenuation of a screening system to be calculated with sufficient accuracy. The appendix contains a detailed mathematical treatment of screening applied to spherical, cylindrical, and multiple concentric screens.

621.314.2.029.5 : 621.396.621.54 **3430**

Two-Frequency I.F.Transformers.—R. T. Thompson. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 142..158.) Description of the construction and performance of transformers for use at 455 kc/s and 8.3 Mc/s.

621.314.5 **3431**

Modern Vibratory Power Converters.—L. S. Distin. (*P.O. elect. Engrs' J.*, July 1946, Vol. 39, Part 2, pp. 53–57.) The principles of operation of rectifying and non-rectifying types, with a description of a rectifier type specially developed for Service use.

621.314.6 **3432**

A Note on Empirical Laws for Non-Linear Circuit Elements and Rectifiers.—Corbyn. (*See* 3195.)

621.316.5 **3433**

Circuit Interruption.—R. W. J. Cockram. (*Elect. Rev., Lond.*, 6th Sept. 1946, Vol. 139, No. 3589, pp. 385–388.) A brief history of circuit-breaking techniques and detailed descriptions of two modern developments: (*a*) the micro-break switch; (*b*) a modified form of the conventional tilting mercury switch.

621.318.323.2.042.15 **3434**

Brown Boveri Powdered-Iron Cores for Filter and Tuned Coils in Communications Engineering.—E. Ganz. (*Brown Boveri Rev.*, Sept. 1944, Vol. 31, No. 9, p. 331.) Figure-of-merit Q is graphed against frequency (0–16 kc/s) for various permeabilities of an annular core, and for different numbers of turns.

621.318.323.2.042.15 : 621.396.662.2 **3435**

Coils with Iron Dust Cores.—I. Avanessoff. (*Onde élect.*, April 1946, Vol. 26, No. 229, pp. 149–154.) An analysis of the losses associated with the cores, and a description of methods of measuring the components of these losses. It is shown that the performance and the optimum frequency range for such coils can be calculated from a knowledge of the constructional details of the coil and the magnetic characteristics of the core. Experimental confirmation is given for a typical case.

621.319.51 **3436**

Electrode Evaporation and the Electric Spark.—F. L. Jones. (*Nature, Lond.*, 9th March 1946, Vol. 157, No. 3984, pp. 298–299.) An equation is given which shows that for minimum erosion the electrodes should be composed of a material with the highest boiling point, density, and thermal conductivity. Good agreement with experimental data has been obtained in the case of aero-engine sparking plugs.

621.384 **3437**

The Racetrack: a Proposed Modification of the Synchrotron.—H. R. Crane. **The Stability of Orbits in the Racetrack.**—D. M. Dennison & T. H. Berlin. (*Phys. Rev.*, 1st/15th May 1946, Vol. 69, Nos. 9/10, pp. 542 & 542-543.)

621.384 **3438**

Methods for Betatron or Synchrotron Beam Removal.—E. C. Crittenden, Jr., & W. E. Parkins. (*J. appl. Phys.*, June 1946, Vol. 17, No. 6, pp. 444–447.) Two methods are discussed: one uses "a perturbing magnetic field to focus the electrons as they are made to leave the field of the accelerator by means of orbit expansion" ; the other "makes use of a pulsed deflecting system where the deflecting field is applied during a time short compared to the period of revolution of the electrons."

621.384 **3439**
Removal of the Electron Beam from the Betatron.—L. S. Skaggs, G. M. Almy, D. W. Kerst & L. H. Lanzl. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 95.)

621.384 **3440**
The Stability of Synchrotron Orbits.—D. M. Dennison & T. H. Berlin. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos 1/2, pp. 58–67.) Approximate solutions are obtained for the equations of motion of electrons in a synchrotron employing a frequency-modulated accelerating voltage. The electron orbits are shown to be stable. A numerical example is given.

621.396.66 **3441**
Broadcast Station Alarm System for Carrier and Program Failures.—R. R. Taylor. (*Communications*, Aug. 1946, Vol. 26, No. 8, pp. 20 . . 55.) The circuit is given, and precautions to prevent actuation of the relays by momentary surges and so forth are detailed.

621.398 : 621.396.677 **3442**
A Simple Method of Controlling the Beam Antenna.—Harris. (*See* 3191.)

TELEVISION AND PHOTOTELEGRAPHY

621.396.615.17 : [621.317.755
+ 621.397.331.2 **3443**
Current Oscillator for Television Sweep.—Sziklai. (*See* 3220.)

621.397 **3444**
First Facsimile Newspaper printed in Air Transport's Cabin.—(*Telegr. Teleph. Age*, Aug. 1946, Vol. 64, No. 8, pp. 12, 14.) Brief description of equipment which gives a reception rate of 500 words/minute, and which can be adapted to transmit and receive flight and weather information from aircraft in flight.

621.397(73) **3445**
Apparatus and Standards for Television Broadcasting in the U.S.A.—D. G. Fink. (*Alta Frequenza*, March 1946, Vol. 15, No. 1, pp. 40–43.) Summarized excerpts in Italian from 3955 of 1945.

621.397.611 : 621.383.8 **3446**
Television Pickup Tubes.—Blanc-Lapierre & Chantereau. (*See* 3472.)

621.397.62 **3447**
Television Receivers.—R. A. Monfort. (*Radio News*, Aug. 1946, Vol. 36, No. 2, pp. 41–44 . . 150.) A discussion of some of the technical features, including aerial design, f.m. sound channels, alignment of the video i.f. amplifier, the differentiating and integrating circuits in the synchronizing stages, and the use of test patterns.

621.397.813 **3448**
Theoretical Investigation of the Distortion of Television Signals in Valve Circuits.—Huber. (*See* 3228.)

TRANSMISSION

621.396.61 + 621.396.621 **3449**
Inside the Handie-Talkie.—R. F. Scott. (*Radio Craft*, July 1946, Vol. 17, No. 10, pp. 684 . . 724.) Description, with circuit diagrams, of the U.S. Army equipment SCR-536.

621.396.61 **3450**
Broadcast Transmitter Designs as Determined by a Market Survey.—M. R. Briggs. (*Communications*, Aug. 1946, Vol. 26, No. 8, pp. 11–14, 44.) An account of a survey of opinions and preferences of 91 station managers and operators.

621.396.61 **3451**
Special Transmitters for Wireless Broadcasting, Telephony, and Telegraphy.—M. Dick. (*Brown Boveri Rev.*, Sept. 1944, Vol. 31, No. 9, pp. 281–287.) Describes the mechanical layout, with the aid of photographs, of 10-kW transportable medium- and short-wave transmitters.

621.396.61 : 621.396.619.018.41 **3452**
Direct F.M. Transmitters.—N. Marchand. (*Communications*, Aug. 1946, Vol. 26, No. 8, pp. 24 . . 54.) A typical transmitter is described consisting of an exciter unit employing a reactance-tube-modulated oscillator, frequency multiplying stages, and r.f. class-C amplifier stages. The oscillator frequency is automatically stabilized by a two-phase motor in conjunction with a crystal. Part 8 of a series ; for previous parts see 3105 of October and back references.

621.396.61 : 621.396.99 **3453**
Transmitting Stations for Police Forces and Fire Brigades.—H. Labhardt. (*Brown Boveri Rev.*, March 1945, Vol. 32, No. 3, pp. 105–109.) A non-technical description, with photographs, of the applications of s.w. and u.s.w. equipments.

621.396.61.029.56 **3454**
Flea Power Voice Transmitter.—A. B. Kaufman. (*Radio News*, Aug. 1946, Vol. 36, No. 2, pp. 35 . . 142.) Design and construction of a crystal-controlled single-tube transmitter of small size for operation in the 3-Mc/s region. A pentode is used with suppressor-grid voice modulation.

621.396.61.029.58 **3455**
The "Monobloc" Short-Wave 15-kW Broadcast Transmitters Type TH 1417.—M. Guérineau. (*Rev. tech. Comp. franç. Thomson-Houston*, April 1946, No. 5, pp. 31–36.) Detailed description of the mechanical and electrical design of a transportable and easily erected transmitter. At 95% modulation the harmonic distortion is less than 2% for 50–3 000 c/s and 3.5% for 3 000–5 000 c/s. The noise modulation is 55–60 db below the level corresponding to 80% modulation at 800 c/s. The transmitter can operate on the broadcasting bands of λ 16, 19, 25, 31 and 41 m.

621.396.61 + 621.396.621].029.62 **3456**
Transmitter-Receiver for Ham Beginners : Part 1.—Sullivan. (*See* 3405.)

621.396.61.029.62 **3457**
Crystal Controlled 2-Meter Transmitter.—W. D. Speight. (*Radio News*, Aug. 1946, Vol. 36, No. 2, pp. 36 . . 117.) Design and constructional details. A 7.2-Mc/s crystal is used with one quintupler and two doubler stages feeding the final amplifier.

621.396.61 + 621.396.621].029.63 **3458**

2 700 Mc/s Transceiver.—K. H. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 104–105.) A short technical description of a portable (56 lb in two packs) highly directional telephone equipment, including a circuit diagram and sectional drawing of the cavity resonator used with the GL-446 lighthouse tube. Reliable range 30 miles.

621.396.61.029.64 **3459**

430 Mc/s with a 6F4.—I. Queen. (*Radio Craft*, July 1946, Vol. 17, No. 10, pp. 687 . . 724.) Constructional details of a coaxial-cavity amateur transmitter.

621.396.611.21 : 621.396.615 **3460**

A 100 kc/s Quartz Frequency Sub-Standard and Harmonic Generator.—Nield. (*See* 3363.)

621.396.619 **3461**

Modulation : Part 1—Physical Basis [of amplitude and phase modulation].—O. Henkler & R. Otto. (*Arch. tech. Messen*, Sept. 1940, No. 111, pp. T97–98.)

621.396.619 **3462**

Class B Modulator Design.—Grant. (*See* 3221.)

621.396.619.018.41 **3463**

Frequency Modulation : Parts 1 & 2.—Matricon. (*See* 3419.)

621.396.645.3 **3464**

[Short Wave] **Transmitter Output Stage.**—H. D. Hooton. (*Radio Craft*, Aug. 1946, Vol. 17, No. 11, pp. 755–799.) Constructional details of a neutralized push-pull r.f. amplifier designed to work from an exciter delivering 30–100 W.

VALVES AND THERMIONICS

537.221 **3465**

Contact Potential Difference in Crystal Rectifiers.—W. E. Meyerhof. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 106.) The contact potential of (mainly) silicon-metal point contact rectifiers has been measured (*a*) by variation of d.c. contact resistance as a function of temperature and (*b*) by the Kelvin method where the semiconductor and metal are not in contact. The poor correlation between the results from the two methods "is probably caused by layers on the semiconductor and metal which undergo changes in forming a contact". See also 1282 of May (Meyerhof & Miller).

Abstract of an Amer. Phys. Soc. paper.

621.3.032.21 : 537.585 **3466**

Positive Ions from Thoriated Tungsten.—G. A. Jarvis. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 106.) The specimen is prepared by heating to above 2 600°K, so as to reduce the thorium dioxide. It is then found "that the temperature dependence of positive thorium ion emission is similar to that for positive ions from pure metals". Simultaneous measurements made with a magnetic analyser on the emission of thorium and tungsten positive ions as a function of temperature yield approximate values for the work functions. The growth of the thorium layer on a filament at 2 000°K has been examined.

Abstract of an Amer. Phys. Soc. paper.

621.3.032.216 : 537.533.8 **3467**

Secondary Electron Emission from Oxide-Coated Cathodes : Part 2.—M. A. Pomerantz. (*J. Franklin Inst.*, July 1946, Vol. 242, No. 1, pp. 41–61.) Conclusion of 3107 of October. The apparatus and results are described in detail.

It is found that above a critical temperature, near that at which thermionic emission became appreciable, there was a time lag in the decay of the secondary emission after stopping the primary radiation. This is shown to be due to space-charge phenomena (see also 1482 of 1945—Johnson). The average energy of secondary electrons decreases as the target temperature is increased, so that the total energy of secondary emission remains roughly constant or tends to decrease although the total emission current rises. A qualitative explanation is suggested.

621.3.032.216 : 537.533.8 **3468**

The Temperature Dependence of Secondary Electron Emission from Oxide-Coated Cathodes.—M. A. Pomerantz. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, pp. 33–40.) "Experiments have been performed with three types of apparatus [see 3467 above]. Yield *vs.* energy data reveal values of δ of 4–7 at room temperature with a more or less flat maximum at approximately 1 000 V primary energy." Extrapolation of data suggests yields exceeding 100 at 850°C, but the product of yield and average energy per secondary decreases with increase in temperature. The temperature dependence of the yield is discussed but no satisfactory explanation is found. Yields under pulsed and steady state conditions are in agreement and the secondary emission, except in the presence of certain space charge effects, follows the primary waveform.

621.314.632 : 546.289 **3469**

The Photo-Diode and Photo-Peak Characteristics in Germanium.—Benzer. (*See* 3314.)

621.319.7 : 621.385 **3470**

Potentiograms and Electron Trajectories in Electrostatic Fields.—Pinciroli & Panetti. (*See* 3322.)

621.383.8 : 535.61–15 **3471**

Infrared Image Tube.—G. A. Morton & L. E. Flory. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 112–114.) A description of the R.C.A. 1P25 image converter. Electrons emitted by a photoelectric screen (cathode) sensitive to infra-red light are focused by an electron-lens on to a fluorescent screen of synthetic willemite. The cathode is made by depositing a base layer of silver on the glass of the tube, the layer is "completely oxidized and processed with additional silver, caesium and silver, with an appropriate thermal treatment". Application to various types of infra-red telescope is mentioned. See also 2661 of September and 2346 of August.

621.383.8 : 621.397.611 **3472**

Television Pickup Tubes.—A. Blanc-Lapierre & J. Chantereau. (*Rev. tech. Comp. franç. Thomson-Houston*, Oct. 1945, No. 4, pp. 25–44.) Description of the principles of operation, construction, and characteristics of the Emitron and Superemitron types of camera. The paper concludes with a brief discussion of the advantages of "slow electron" tubes in which the collector anode is at zero potential.

621.385 **3473**

Demonstration of a Water-Jet Analogue of the Reflection Klystron.—W. J. Scott. (*Proc. phys.*

Soc., 1st July 1946, Vol. 58, No. 328, pp. 475–476.) The behaviour of the electron beam in the electric field is simulated by a water jet under the influence of the gravitational field. The "bunching" action, as represented by the distribution of water globules, is clearly shown by stroboscopic photographs.

621.385 **3474**

The Construction and Operation of Klystrons.—E. D. Hart. (*R.S.G.B. Bull.*, Sept. 1946, Vol. 22, No. 3, pp. 31–38.) Practical operating adjustments are described in some detail.

621.385 **3475**

Errata : On the Possibility of Purely Electrostatic Focusing in a Velocity Modulation Drift Tube.—P. Guénard. (*Ann. Radioélect.*, Jan. 1946, Vol. 1, No. 3, p. 276.) Corrections to 3878 of 1945.

621.385.1 **3476**

Some Facts concerning the Construction of Brown Boveri Small Tubes.—A. Bertschinger. (*Brown Boveri Rev.*, Sept. 1944, Vol. 31, No. 9, pp. 313–315.) A general description.

621.385.16 **3477**

Space Charge in Plane Magnetron.—L. Page & N. I. Adams, Jr. (*Phys. Rev.*, 1st/15th May, 1946, Vol. 69, Nos. 9/10, pp. 492–494.) "The space charge equation for the plane magnetron is solved, the current is obtained as a function of the magnetic field, and the effect of the magnetic field on the distribution of potential and charge is discussed."

621.385.16 **3478**

Space Charge in Cylindrical Magnetron.—L. Page & N. I. Adams, Jr. (*Phys. Rev.*, 1st/15th May, 1946, Vol. 69, Nos. 9/10, pp. 494–500.) The space charge equation is solved for a system of two coaxial cylindrical electrodes, with a uniform axial magnetic field. Three forms of solution are obtained: (1) applicable near the inner electrode (cathode) for weak magnetic fields ; (2) applicable at large distances from the cathode ; (3) applicable near cut-off. Curves illustrating the results are given.

621.385.16.029.62/.63 **3479**

Split Anode Magnetrons for the 100-800 Megacycle Range.—J. P. Blewett, D. A. Wilbur & L. D. Roberts. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 118.) Cathode back-heating, anode dissipation at high frequencies, and escape of electrons from the anode structure at low frequencies limit the power output. A shielding process permits operation of small glass-enclosed magnetrons at powers greater than 1 kW from 100 to 400 Mc/s. Liquid cooling is used. Powers of 150 W from 350 to 800 Mc/s are obtained by mounting an internal loop in parallel with the external tank circuit.

Abstract of an Amer. Phys. Soc. paper.

621.385.16.029.63 **3480**

Methods of Tuning Multiple-Cavity Magnetrons.—R. B. Nelson. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Now. 1/2, p. 118.) The most successful of several methods tried involves simultaneous variation of inductance and capacitance of all cavities by a single tuning motion. Tuning ranges greater than 1.4 to 1 have been obtained with good efficiency throughout ; for example a magnetron tuning from 760 to 1 160 Mc/s delivering over 2 kW c.w. at all frequencies is described.

Abstract of an Amer. Phys. Soc. paper.

621.385.3 **3481**

Sealed-Off Transmitting Tubes and Their Production.—F. Jenny. (*Brown Boveri Rev.*, Sept. 1944, Vol. 31, No. 9, pp. 309–312.) A general description of the materials used and the methods of assembly, with characteristic curves for a 5-kW air-cooled triode.

621.385.3 **3482**

New Manufacturing Techniques for Transmitter Tubes.—M. Matricon & J. Chantereau. **The Standardization of the Components in the Manufacture of C.F.T.H. Transmitting Tubes.**—R. Montagne. **Test Equipment for Materials in the Manufacture of Electronic Tubes.**—A. Laurent. **Continuously Evacuated Demountable Transmitting Tubes.**—M. Matricon. (*Rev. tech. Comp. franç. Thomson-Houston*, April 1945, No. 2, pp. 5–17, 19–22, 23–32 & 33–39.) Another account of the same material by the same authors is given in 490 of February and 1110 of April.

621.385.832 **3483**

The Image Formation in Cathode-Ray Tubes and the Relation of Fluorescent Spot Size and Final Anode Voltage.—G. Liebmann : H. Moss. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1946, Vol. 34, No. 8, pp. 580–586.) Long discussion of 3030 of 1945 (Liebmann).

621.396.694 **3484**

The Calculation of Amplifier Valve Characteristics.—G. Liebmann. (*J. Instn elect. Engrs*, Part 1, Aug. 1946, Vol. 93, No. 68, pp. 357–358.) Long summary of 2406 of August.

621.396.822 + 537.525.5] : 621.385 **3485**

Noise and Oscillations in Hot-Cathode Arcs.—Cobine & Gallagher. (*See* 3266.)

621.396.822 + 537.525.5] : 621.385 **3486**

Effect of Magnetic Field on Noise and Oscillations in Hot-Cathode Arcs.—Gallagher & Cobine. (*See* 3267.)

621.396.822 : 621.385 [.12 + .18 **3487**

A High Level Electronic Noise Source.—J. D. Cobine & C. J. Gallagher. (*Phys. Rev.*, 1st/15th July 1946, Vol. 70, Nos. 1/2, p. 119.) Continuous spectrum from low audio frequency to above 5 Mc/s built in form of a gas discharge tube with cylindrical electrode structure. The r.m.s. voltage is substantially flat up to 1 Mc/s and drops 18 db from 1–5 Mc/s.

Abstract of an Amer. Phys. Soc. paper.

MISCELLANEOUS

027 : [5 + 6 **3488**

Science Librarianship.—J. W. Hunt. (*Science*, 23rd Aug. 1946, Vol. 104, No. 2695, pp. 171–173.)

058 : [621.38 + 621.396 **3489**

Electronics Buyers' Guide.—The issue of 15th June 1946 contains (in addition to data on sources of supply) charts and tabulated information on the e.m. spectrum, frequency allocations, sound levels, graphical symbols, and solid-dielectric coaxial cables, and also an index to *Electronics* for 1936–June 1946, and a bibliography of about 500 books on electronic and allied subjects.

347.771 **3490**

Patent Law Reform in Britain.—(*Nature, Lond.*, 6th July 1946, Vol. 158, No. 4001, pp. 1–3.) Editorial on second interim report of the Departmental Committee on the Patent and Design Acts, dealing with the alleged abuse of monopoly rights, the grant of worthless patents, and the legal procedure for the determination of patent rights.

518.3 **3491**

Alignment Chart Construction.—D. C. French. (*Proc. Instn Radio Engrs, Aust.*, June 1946, Vol. 7, No. 6, pp. 11–20.) A non-theoretical explanation.

519.283 : 519.24 **3492**

A Simple Test of Significance.—E. J. Williams : K. K. Schiller. (*Engineering, Lond.*, 24th May & 14th June 1946, Vol. 161, Nos. 4193 & 4196, pp. 496 & 568.) Two letters discussing the test proposed by " A. Mateur " (2427 of August).

621.3 + 537 + 538].081 **3493**

Electrical Units and the MKS System.—H. P. Williams. (*Elect. Comm.*, March 1946, Vol. 23, No. 1, pp. 96–106.) An instructional review.

621.3 **3494**

I.R.E.-U.R.S.I. Convene.—(*Electronic Industr.*, July 1946, Vol. 5, No. 7, pp. 75–77, 96.) Summaries of some of the papers read at the joint meeting held in Washington, D.C., in May 1946.

621.3 **3495**

Electrical Progress and Development.—H. W. Richardson. (*G.E.C. J.*, Feb. 1946, Vol. 14, No. 1, pp. 3–56.) Survey of work at British General Electric Co., including radio and communications, measuring instruments, and batteries.

621.3(07) **3496**

A Note on Electrical Engineers Trained [in U.S. schools] **during the War.**—G. H. Fett. (*Proc. Inst. Radio Engrs, W. & E.*, July 1946, Vol. 34, No. 7, pp. 481–482.)

621.3.027.3 : 016.5 **3497**

High-Voltage Engineering.—(*Brown Boveri Rev.*, Sept./Oct. 1943, Vol. 30, Nos. 9/10, pp. 211–291.) This is a special high-voltage engineering number of the journal, giving 16 papers on the properties of insulators, breakdown phenomena, and h.v. laboratory equipment.

621.3.078 : 621.383 **3498**

Step-Control of a Productive Process.—W. Sommer. (*J. sci. Instrum.*, July 1946, Vol. 23, No. 7, pp. 150–154.) Photoelectric device employing a series of filters of varying density for controlling tolerances in mass production processes.

621.3.084(07) **3499**

Education in Instrument Technology. Report of a Discussion held by the Society of Instrument Technology in London on 8 November 1945.—(*J. sci. Instrum.*, July 1946, Vol. 23, No. 7, pp. 161–163.)

621.38 **3500**

Electronics Exhibition.—(*Elect. Rev., Lond.*, 19th July 1946, Vol. 139, No. 3582, pp. 93–94.) A review of the electronic equipment for controlling industrial processes, high-frequency heating, etc., shown at the British Thomson-Houston Co. exhibition. For another account see *Electrician*, 19th July 1946, Vol. 137, No. 3555, pp. 165–167.

621.385 **3501**

Demonstration of a Water-Jet Analogue of the Reflection Klystron.—Scott. (*See* 3473.)

621.396.6 (213) **3502**

Deterioration of Radio Equipment in Damp Tropical Climates and Some Measures of Prevention.—C. P. Healy. (*J. Instn Engrs, Aust.*, April/May 1946, Vol. 18, Nos. 4/5, pp. 73–85.) The nature of moulds, their reproduction, and the preparation of cultures are described. Moulds will grow on almost any organic material, and even on the surface of many inert materials if there is enough organic dust to maintain growth. In such cases the surface may be pitted. A survey of tropical conditions leads to the design of a humidity chamber in which tropical conditions may be simulated. Methods of inoculation of the equipment with mixed mould spores are described. Tests may also be carried out in petri dishes on small specimens and with particular moulds. The effectiveness of various fungicides, when incorporated in waxes, paints, etc., is discussed. The effects of mould on particular parts of equipment (connecting wire, laminated sheet, batteries, etc.) are considered, and methods of prevention or suitable substitutes recommended.

Humidity tests without moulds are outlined, and the effect on individual components considered. Preventive treatments are suggested for transformers, capacitors (paper and mica), ceramics, phenolic mouldings, and sheets. The use of moisture-proof equipment cases is mentioned. See also 809 of March (Collins, Gittoes & Rowed).

621.396.621.004.67 **3503**

Hospitalization for Radios.—O. I. Sprungman. (*Radio News*, Aug. 1946, Vol. 36, No. 2, pp. 45, 151.) Details of a type of insurance under which a yearly premium is paid and servicing is free for the year.

621.396.97 : 7 **3504**

The Search for a Radiophonic Art.—J. Matras. (*Onde élect.*, June 1946, Vol. 26, No. 231, pp. 228–238.) An essay on the aesthetics of broadcasting as a cultural medium, by the chief engineer of the French broadcasting system.

658.311.5 **3505**

The Selection of Engineering Personnel.—F. Holliday. (*J. R. aero. Soc.*, April 1946, Vol. 50, No. 424, pp. 240–261. Discussion pp. 262–274.) A lecture before the Royal Aeronautical Society.

778.142 **3506**

Microfilm.—M. Sollima. (*Rev. tech. Comp. franç. Thomson-Houston*, July 1945, No. 3, pp. 1–20.) A general account, with particular note of cameras and reading apparatus developed by the French Thomson-Houston Company.

519.283 : 62 **3507**

A First Guide to Quality Control for Engineers. [Book Review]—E. H. Sealy. H.M. Stationery Office, London, 1945, 38 pp., 1s. (*Nature, Lond.*, 13th April 1946, Vol. 157, No. 3989, pp. 475–476.) A guide to production engineers in the application of statistical methods of checking and testing in mass production.

551.5(021) **3508**

General Meteorology. [Book Review]—H. R. Byers. McGraw-Hill Book Co., New York, 1944, 645 pp., $5. (*J. appl. Phys.*, June 1946, Vol. 17, No. 6, p. 535.) " . . . recommended to persons interested in modern developments in descriptive and synoptic meteorology."

Correction.—In the October abstracts, for *Physica, Eindhoven* read *Physica, 's Grav.*

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534 + 536] : 538.569.4.029.64 **3509**

Thermal and Acoustic Effects attending Absorption of Microwaves by Gases.—Hershberger. (*See* 3585.)

534.21 **3510**

The Propagation of Sound in the Atmosphere—Attenuation and Fluctuations.—V. O. Knudsen. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, pp. 90–96.)

534.21 **3511**

Propagation of Sound over Absorbent Surfaces.—R. K. Cook. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, p. 252.) Summary of Amer. Acoust. Soc. paper.

534.212 : 534.321.9 **3512**

The Directional Characteristics of a Free-Edge Disk mounted in a Flat Baffle or in a Parabolic Horn.—F. H. Slaymaker, W. F. Meeker & L. L. Merrill. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, p. 251.) When a parabolic horn is excited by a diaphragm at supersonic frequencies, the sharpest beams are obtained with the diaphragm radiating most of its energy towards the side walls. The differential equation for the vibration of a thin free-edge circular disk is solved, and the results tabulated so that the dynamic curve and directional radiation pattern can be calculated for any disk and frequency. Summary of Amer. Acoust. Soc. paper.

534.32 **3513**

A Hundred-Element Tone Synthesizer.—E. C. Wente, C. A. Lovell & J. F. Muller. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, p. 253.) A complex electric current is generated by a combination of up to one hundred sine-wave currents derived from magnetic records, each of which is variable in amplitude and substantially free from harmonics. Summary of Amer. Acoust. Soc. paper.

534.321.9 : 534.241 **3514**

Echo Formation on Simple Surfaces.—C. E. Mongan, Jr. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, p. 255.) A laboratory technique has been devised for the observation of supersonic echo formation at plane, cylindrical, and spherical discontinuities. Summary of Amer. Acoust. Soc. paper.

534.321.9 : 549.514.51 **3515**

Refinements in Supersonic Reflectoscopy. Polarized Sound.—F. A. Firestone & J. R. Frederick. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, pp. 200–211.) Supersonic waves of various types can be radiated by suitable excitation of quartz crystals and can be used, in a reflectoscope, for the detection of flaws in metals by the reflections they produce. The reflectoscope has also been used extensively for studying the laws of reflection and refraction of polarized sound in solids.

534.41 + 534.781 **3516**

The Portrayal of Visible Speech.—J. C. Steinberg & N. R. French. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, pp. 4–18.) The object is to produce a satisfactory time-intensity-frequency (three-dimensional) speech pattern. The best scales for such a diagram, and other possible developments suggested by the physiological characteristics of speech and reading, are discussed. Methods of evaluating pattern legibility are also suggested.

534.41 + 534.781 **3517**

The Sound Spectrograph.—W. Koenig, H. K. Dunn & L. Y. Lacy. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, pp. 19–49.) The mechanical arrangements and electrical circuits are described. Time-intensity-frequency records of a wide variety of sounds are shown and the problems arising in their analysis are discussed.

534.41 + 534.781 **3518**

Basic Phonetic Principles of Visible Speech.—G. A. Kopp & H. C. Green. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, pp. 74–89.) The visible characteristics of the various fundamental phonetic sounds, classified according to their method of production, are shown pictorially and discussed. Racial and individual differences of speech are also considered.

534.41 + 534.781] : 535.37 **3519**

Visible Speech Translators with External Phosphors.—H. Dudley & O. O. Gruenz, Jr. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, pp. 62–73.) Speech patterns, analysed on an intensity-frequency-time basis, are displayed on an endless moving phosphorescent belt. Any pattern is visible for about 1¼ sec after which it is erased by red lamps.

534.41 + 534.781] : 621.385.832 **3520**

Visible Speech Cathode-Ray Translator.—R. R. Riesz & L. Schott. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, pp. 50–61.) The special cathode-ray tube has a persistent screen in the form of a cylindrical band, and is rotated about a vertical axis. The electron beam always excites the screen in the same vertical plane, so the speech patterns, portrayed both as a spectrum and as a pitch analysis, appear along a horizontal time axis. The translator has been used to study patterns of speech sounds and their combinations. Trained observers can interpret the pictures of conversational speech at 90–120 words per minute.

534.417 : 534.88 **3521**

Echo Ranging Sonar [model QCS/T].—Evans. (*See* 3605.)

534.7 **3522**

Effects of Distortion on the Intelligibility of Speech at High Altitudes.—G. A. Miller & S. Mitchell. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, p. 250.) " Sounds spoken into the closed cavity of an oxygen mask at high altitudes differ substantially in quality and intensity from normal speech at sea level." The most satisfactory method of correcting this appears to be sharp, symmetrical limiting (" peak clipping "). Summary of Amer. Acoust. Soc. paper.

534.7 **3523**

The Effects of High Altitude on Speech and Hearing.—H. W. Rudmose, K. C. Clark, F. D. Carlson, J. C. Eisenstein & R. A. Walker. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, pp. 250–251.) Measurements of speech energy, made at simulated altitudes from sea level to 40 000 ft show that the energy decrement of vowels and semi-vowels, expressed in decibels, varies uniformly with altitude but there is little change in unvoiced consonants, or in the threshold of hearing. Summary of Amer. Acoust. Soc. paper.

534.78 **3524**

Effects of Amplitude Distortion upon the Intelligibility of Speech.—J. C. R. Licklider. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, p. 249.) Amplitude distortion of various forms was introduced into otherwise high-quality audio systems by the use of nonlinear circuits. Tests indicated that cutting of peaks resulting from overdriving the amplifiers had little detrimental effect on intelligibility whereas cutting of the low amplitude part of the speech had a serious effect. The reduction in intelligibility caused by distortion increases when noise is mixed with the speech, except when the noise consists of pulses and the distortion limits them. Summary of Amer. Acoust. Soc. paper.

534.78 **3525**

Effects of Frequency Distortion upon the Intelligibility of Speech.—J. P. Egan & F. M. Wiener. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, pp. 249–250.) Bandwidths used for frequency-distortion tests ranged from half an octave to the whole of the speech frequency range. Articulation increased with the intensity level of the received speech, but less rapidly the smaller the bandwidth. When the speech is mixed with a uniform spectrum of noise, and speech and noise are together passed through a filter, articulation differs very little from that obtained by filtering the speech only, before mixing with the noise. When, however, the noise level falls rapidly as a function of frequency, articulation can be improved by filtering both noise and speech. Summary of Amer. Acoust. Soc. paper.

534.78 **3526**

Correlation of the Audio Characteristics of Communication Systems with Measured Articulation Scores.—L. L. Beranek. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, p. 250.) A method has been devised for determining the ability of a communication system to transmit speech intelligibly. " The results indicate that it is possible to estimate from physical data the performance of a system in an assumed ambient noise field." Summary of Amer. Acoust. Soc. paper.

534.78 **3527**

The Masking of Speech by Sine Waves, Square Waves, and Regular and Randomized Pulses.—S. S. Stevens, J. Miller & I. Truscott. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, p. 250.) The most effective frequency for the masking of speech by sine waves is about 300 c/s for intense waves and 500 c/s for weak waves. Square waves are approximately equally effective between 80 c/s and 400 c/s. Regular pulses with a duration of 10 μs are most effective at about 200 pulses/sec but when the pulses occur at random time intervals the masking is greatly increased. Summary of Amer. Acoust. Soc. paper.

534.84 **3528**

Note on Normal Frequency Statistics for Rectangular Rooms.—R. H. Bolt. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, pp. 130–133.) A graphical method for determining the average number and spacings of normal frequencies, up to a given frequency, for a rectangular room of known dimensions.

534.84 **3529**

The Design and Construction of Anechoic Sound Chambers.—L. L. Beranek & H. P. Sleeper, Jr. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, pp. 140–150.)

534.844.1 **3530**

The Measurement of Reverberation.—W. Tak. (*Philips tech. Rev.*, March 1946, Vol. 8, No. 3, pp. 82–88.) In rooms and auditoria. Theoretical discussion of principles of measurement ; apparatus used will be described in a subsequent article.

621.394/.396].645 **3531**

The Multiamp.—Jackson. (*See* 3559.)

621.395.61 : 534.64 **3532**

Motional Impedance Analysis applied to a Dynamic Microphone.—J. E. White. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, pp. 155–160.) A method whereby the pressure sensitivity at low audio frequencies, the microphone mechanical impedance, and other characteristics may be calculated.

621.395.613.38 **3533**

Magnetic Throat Microphones of High Sensitivity.—D. W. Martin. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, p. 253.) Summary of Amer. Acoust. Soc. paper.

621.395.623.6 **3534**

Development of Midget Earphones for Military Use.—H. A. Pearson, A. B. Mundel, R. W. Carlisle, W. Knauert & M. Zaret. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, p. 253.) Summary of Amer. Acoust. Soc. paper.

621.395.623.7 **3535**

The Output Stage.—Stanley. (*See* 3727.)

621.395.623.8 : 621.396.932 **3536**

Marine Loudspeaking Gear.—P. Hickson. (*Wireless World*, Aug. 1946, Vol. 52, No. 8, pp. 254–255.) Description of Ardente "Loud Hailer" type 431, which was designed for inter-ship communication to work off a 12-V accumulator, high voltage being supplied by a small motor generator. The audio amplifier gives an output of 15 W which was found sufficient for the purpose and enabled the apparatus to be kept small; it weighed 23 lb. The frequency response curve of the amplifier is flat from 300 to 10 000 c/s, attenuation being introduced at the lower end to match the characteristics of the loudspeaker unit.

621.395.667 **3537**

Fundamental Tone Control Circuits—A Reference Sheet.—(*See* 3728.)

621.395.92 **3538**

Desirable Frequency Characteristics for Hearing Aids.—H. Davis, C. V. Hudgins, G. E. Peterson & D. A. Ross. (*J. acoust. Soc. Amer.*, July 1946, Vol. 18, No. 1, p. 247.) Characteristics investigated included one with uniform acoustic gain from 100 to 7 000 c/s, and others with a slope of either 6 db or 12 db per octave towards either the high or the low frequencies. Tests on hard-of-hearing subjects showed that the best articulation was achieved with the flat characteristic or one with a 6 db per octave slope increasing towards the high frequencies. This was also true in the presence of static noise. Summary of Amer. Acoust. Soc. paper.

AERIALS AND TRANSMISSION LINES

621.392 **3539**

A Fractional Termination for Ladder Networks.—W. R. LePage. (*Trans. Amer. Inst. elect. Engrs*, Aug./Sept. 1946, Vol. 65, Nos. 8/9, pp. 530–536.) A theoretical survey of the possibilities of using a new termination for a uniform ladder network, which renders it more nearly like its corresponding circuit of distributed constants than either the mid-shunt or mid-series terminated types, is given. The improvement, which holds only over a limited frequency range, is small, becoming less as the number of sections is increased.

621.392 **3540**

Anomalous Attenuation in Waveguides.—D. A. Bell. (*Wireless Engr*, Oct. 1946, Vol. 23, No. 277, pp. 287–288.) A note on a pictorial and qualitative method of showing the variation with frequency of attenuation in waveguides, prompted by a paper by Kemp. A correction to this paper appears at the bottom of p. 289; the original paper was abstracted in 2818 of October.

621.392 **3541**

A Theory of the Narrow Resonant Slit in a Wave Guide Partition.—E. S. Akeley. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 697.) "The ratio r of the amplitude of the transmitted radiation at infinity to the incident amplitude is determined. Resonance occurs at $k = \pi/2L$ for infinitely narrow slit and $r = 1$ at resonance. These results are independent of the position of slit in partition. Formulas are given for the determination of the shape of the resonance maximum and shift of same from $k = \pi/2L$." Summary of Amer. Phys. Soc. paper.

621.392 : 538.566 **3542**

The Scattering of Electromagnetic Radiation by a Thin Circular Ring in a Circular Wave Guide.—P. Feuer & E. S. Akeley. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 697.) "The ratio of the scattered field to the incident field at a great distance from the obstacle is computed and also the position and shape of the resonance maximum." Summary of Amer. Phys. Soc. paper.

621.392 : 621.315.1 **3543**

Flexible Wave Guides.—A. R. Anderson & A. M. Winchell. (*Electronics*, Aug. 1946, Vol. 19, No. 8, pp. 104–109.) Three types of flexible waveguides are described, the first consisting of a metal strip wound spirally about a rectangular former; the second, a series of circular sections held by an internally ribbed synthetic rubber jacket; and the third, a thin-walled, seamless corrugated rectangular tube. The construction of each is given in detail and their characteristics tabulated. Their possible uses are discussed and the mechanical limitations of each type are considered. There is appreciable leakage of energy from the second type which also suffers from the disadvantage of restricted frequency coverage.

621.396.67 **3544**

More about Aerials—Polarization: Gain: Reflectors.—"Cathode Ray". (*Wireless World*, Aug. 1946, Vol. 52, No. 8, pp. 251–253.) An elementary discussion of electromagnetic fields and the abovementioned properties of aerials. For part 1 see 2821 of October.

621.396.67.013 **3545**

The Magnetic Antenna.—L. Page. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, pp. 645–648.) The antenna investigated is an infinitely long cylindrical rod (radius a, permeability μ, permittivity κ) with a few turns wound around the centre. The increase of flux is given by equation (14) and is shown graphically as a function of λ/a in Figs. 1 and 2. For constant κ there is a critical wavelength λ_m, approximately proportional to $\sqrt{\mu}$, at which the flux ratio exhibits a sharp maximum, while for constant μ the flux ratio increases strongly with increase of κ. If $\kappa = 25$, $\mu = 100$, and $a = 2$ cm, then $\lambda_m = 3$ m, and the value of the flux ratio is 7.2. This effect has a possible practical application.

621.396.67.08.011.2 **3546**

Antenna Impedance Measurement.—King. (*See* 3684.)

621.396.671 **3547**

The Cylindrical Antenna: Current and Impedance.—R. King & D. Middleton. (*Quart. appl. Math.*, July 1946, Vol. 4, No. 2, pp. 199–200.) Correction to 1453 of June.

621.396.677 **3548**

A Comparison of the Efficiencies of Rhombic Type Aerials.—I. M. Ruschuk. (*Vestnik Elektropromyshlennosti*, 1946, No. 2, pp. 13–18. In Russian.) Mathematical discussion showing that the gain of a variation of the broadside rhombic aerial, as proposed by Eisenberg, is 1.8 times higher on short waves and 1.53 times higher on long waves than in the case of an ordinary rhombic aerial.

621.396.679.4.012.2 **3549**

Solving Feeder Problems Graphically.—R. E. Kelley. (*QST*, Sept. 1946, Vol. 30, No. 9, pp. 25–27..140.) Explains the use of a circle diagram to calculate the impedance of a line for given loads and for given lengths.

CIRCUITS

621.3.014/.015].33 : 517.942.82 **3550**

Switching Problems and Instantaneous Impulses.—J. C. Jaeger. (*Phil. Mag.*, Sept. 1945, Vol. 36, No. 260, pp. 644–651.) Discussion of the application of the Laplace transform to circuits or linear systems in which an instantaneous change of conditions is imposed; the work of Ghizzetti (*R.C. Circ. Math. Palermo*, 1937, Vol. 61, p. 339) is critically considered. The paper includes a treatment of the case of an impulsive current or e.m.f. having a very large magnitude and very small duration, but finite time-integral.

621.314.015.33 **3551**

Pulse Transformer Ratings based on Energy Considerations, and Methods of Design based on Thermodynamical Considerations.—W. H. Bostick. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 697.) Summary of Amer. Phys. Soc. paper.

621.315.14.011.3/.4 **3552**

Geometric Mean Distances for Rectangular Conductors.—H. B. Dwight. (*Trans. Amer. Inst. elect. Engrs*, Aug./Sept. 1946, Vol. 65, Nos. 8/9, pp. 536–538.) Values of geometric mean distances are given in graphical form for the calculation of reactance of parallel conductors of rectangular cross-section, for a wide range of dimensions and spacings. The formulae used and method of application to practical cases are illustrated by examples.

621.392 **3553**

A Fractional Termination for Ladder Networks.—LePage. (*See* 3539.)

621.392 : 621.315.59 **3554**

Nonlinear Circuit Element Applications.—H. E. Kallmann. (*Electronics*, Aug. 1946, Vol. 19, No. 8, pp. 130–136.) Applications considered comprise bridge circuits in which nonlinear elements are combined with ordinary resistors to improve power supply regulation; use as limiters to facilitate pulse squaring; and logarithmic scaling. The application of the latter in electrical computing operations is briefly described.

621.392.012.2.029.64 **3555**

A Circle Diagram for Resonant Microwave Systems.—W. Altar. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 697.) "The diagram permits the mapping, in the complex plane, of load impedances or reflection coefficients, of such contour lines as loaded resonator Q, frequency pulling, and the circuit efficiency." Summary of Amer. Phys. Soc. paper.

621.394/.397].645 **3556**

Minimal Noise Amplifiers.—E. J. Schremp. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, pp. 695–696.) "The present unified method, employing a simple principle valid at all frequencies, consists of two successive steps: (1) for each independent internodal tube noise generator, apply the constraint that the ratio vanish between its output response and that of the signal source; and (2) introduce small variations from the resulting constraints, to secure a compromise in gain, bandwidth, stability, and noise figure." Summary of Amer. Phys. Soc. paper.

621.394/.397].645 **3557**

Cathode Follower Coupling in D.C. Amplifiers.—Y. P. Yu. (*Electronics*, Aug. 1946, Vol. 19, No. 8, pp. 99–103.) The use of phase inverter circuits employing a high-value common cathode resistor is discussed, and the reduction of circuit noise considered. A high-gain (60 db) amplifier was designed for a single 250-V power supply, using a cathode follower as an inter-stage coupling element, and with injection on to the screen grid: the circuit noise level was "almost unmeasurably low".

621.394/.397].645.34 **3558**

Termination Effects in Feedback Amplifier Chains.—A. J. Ferguson. (*Canad. J. Res.*, July 1946, Vol. 24, Sec. A, No. 4, pp. 56–78.) An analysis is carried out of a typical i.f. or video feedback amplifier chain to investigate the influence of the input and output circuits on the overall frequency response. The analysis is similar to that of a four-terminal passive network and the solution to the network equations can be resolved into a wave advancing from the input to the output and another reflected back through the amplifier to the input. Performance can thus be expressed in terms of the reflection coefficients of the source and terminal impedances. Reflection coefficients are calculated for typical simple circuits used with amplifiers of three, four and five stages, and many of the derived frequency response curves are unsatisfactory. Considerably better curves may be obtained by using rather more complex terminations, and the best curves result from matching the amplifier chain to both the source and the load. Matching, however, limits the overall gain to half the value which could otherwise be achieved.

621.394.396].645 **3559**

The Multiamp.—C. E. Jackson. (*Radio News*, Sept. 1946, Vol. 36, No. 3, pp. 58..155.) An amplifier giving 30 W high-fidelity output over the entire audio range, with a total harmonic distortion of less than 2%, and noise level 60 db below 30 W on the microphone channels. Higher outputs, up to 90 W, can be obtained by adding compact booster units using 6V6 valves; the power gain of the valves is increased by applying abnormally high anode and screen voltages and controlling the anode current by a simple network. The output transformer is provided with tappings giving fifteen possible impedance values for matching purposes. The input channels include two 125-db gain microphone stages and two 85-db gain programme stages.

621.395.667 **3560**

Design of Attenuation Equalizers.—H. N. Wroe. (*Wireless Engr*, Oct. 1946, Vol. 23, No. 277, pp. 272–280.) From theoretical considerations a method of accurately calculating the performance of an equalizer is deduced. Its application in particular to telephone cables is illustrated. Equalizer performance is found to depend on two quantities which can be calculated without making conventional assumptions concerning its internal structure. A general method of equalizer design is deduced.

621.396.611 **3561**

The Tapped Inductor Circuit.—J. E. Haworth. (*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, pp. 284–286.) The tapped inductor, in conjunction with a suitable capacitor, is considered as a two-terminal network possessing both resonant and anti-resonant properties. Expressions for impedance are derived and the results illustrated graphically. The application of the theory in the design of valve oscillators is discussed.

621.396.621.53.018.41.012.7 **3562**

Mixer Frequency Charts.—Badessa. (*See* 3737.)

621.396.645.014.332 **3563**

Peak Pulse Currents in Class B Amplifiers.—K. R. Sturley. (*Wireless Engr*, Oct. 1946, Vol. 23, No. 277, p. 286.) A simpler method than that involving Fourier analysis of the waveform, and only slightly less accurate, for estimating the peak pulse anode current taken by a valve in class-B operation, including the effect of the "standing feed".

GENERAL PHYSICS

531.18 : 531.15 **3564**

Is Rotation Relative or Absolute?—G.W.O.H. (*Wireless Engr*, Oct. 1946, Vol. 23, No. 277, pp. 263–264.)

534.2 : 550.34 **3565**

Studies on Seismic Waves: Part 1—Reflection and Refraction of Plane Waves. Part 2—Rayleigh Waves in a Superficial Layer.—C. Y. Fu. (*Geophys.*, Jan. 1946, Vol. 11, No. 1, pp. 1–23.)

535.215.1 + 621.383.2 **3566**

Complex Photocathodes.—Khlebnikoff. (*See* 3780.)

535.247.4 **3567**

The Specification of a Spectral Correction Filter for Photometry with Emission Photocells.—J. S. Preston. (*J. sci. Instrum.*, Sept. 1946, Vol. 23, No. 9, pp. 211–216.)

535.312.2 **3568**

Reflection [of light] **in a Corner formed by Three Plane Mirrors.**—J. L. Synge. (*Quart. appl. Math.*, July 1946, Vol. 4, No. 2, pp. 166–176.) Consideration of the case where the three planes are not mutually perpendicular.

536 : 621.3.012.8 **3569**

Electrical Solution of Thermal Problems.—F. G. Willey. (*Electronics*, Aug. 1946, Vol. 19, No. 8, pp. 190..198.) By setting up an analogous electrical circuit, difficult thermal problems can sometimes be rapidly solved. Typical examples are given.

536.21 : 517.942.9 **3570**

Heat Conduction in Elliptical Cylinder and an Analogous Electromagnetic Problem.—N. W. McLachlan. (*Phil. Mag.*, Sept. 1945, Vol. 36, No. 260, pp. 600–609.) The electromagnetic problem is that of a long uniform solenoid with a core of elliptical cross-section in which a constant current I_0 is applied at $t = 0$. The magnetizing force at any point in the core and the (variable) inductance of the solenoid due to the core flux are calculated.

537.13 **3571**

Production and Annihilation of Negative Protons.—(*Nature, Lond.*, 24th Aug. 1946, Vol. 158, No. 4008, pp. 280–281.) A short account of a theoretical paper by J. McConnell published in *Proc. roy. Irish Acad.*, discussing the possibility of observing negative protons which may be produced by collisions of mesons in cosmic rays.

537.2 : 621.317.72 **3572**

The Investigation of Electrostatic Fields by means of a Valve Voltmeter.—R. Street. (*J. sci. Instrum.*, Sept. 1946, Vol. 23, No. 9, pp. 203–204.) "The electrostatic field between two overlapping parallel planes has been investigated by means of a radioactive source and a valve electrometer. The equipotentials so obtained are in satisfactory agreement with the theoretical curves calculated from a Schwarz-Christoffel transformation. The experiment can be adapted as a laboratory exercise."

537.52 : 621.3.015.5.029.64 **3573**

Electrical Breakdown in Air at Microwave Frequencies.—D. Q. Posin. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 696.) "The Paschen Law was found to be approximately valid in this range, as in d.c., though dependent upon the length of time that the microwave field is applied." Summary of Amer. Phys. Soc. paper.

537.52 : 621.3.029.64 **3574**

Complex Conductivity of Electrical Discharge in Gas at Microwave Frequencies.—M. A. Herlin & S. C. Brown. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 696.) "The complex conductivity as a function of power gives the voltage and current characteristic of the discharge. Voltage and complex current characteristics have been studied as a function of cavity dimensions, tube dimensions, and pressure." Summary of Amer. Phys. Soc. paper.

537.521.6 : 533.5 **3575**

The Insulation of High Voltages in Vacuum.—J. G. Trump. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 692.) Field emission theory is inadequate to account for insulation breakdown. Other mechanisms investigated include emission of particles by impact, and photoelectric emission. Summary of Amer. Phys. Soc. paper.

537.525 **3576**

A Generalization of the Conception of Electron Plasma.—A. A. Vlasoff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 5, pp. 248–266. In Russian.) The importance of the interaction between electrons over distances exceeding their average spacing (" distant forces ") is emphasized. If this interaction is taken into account, new dynamic properties of polyatomic systems become apparent, and the conceptions of " gas ", " liquid " and " solid body " are modified towards greater unification with the conception of plasma. The problem of the transition from " micro " to " macro " is also understood in a different light. The main result is the proof that if the fundamental kinetic equation (1) is used, in which the distant interaction is taken into account, the spontaneous appearance of the crystalline structure from the gas (under suitable conditions with regard to density and temperature) becomes evident without the use of any additional hypotheses. The same applies to the appearance of peculiar " vibrational " properties in polyatomic systems. Conditions necessary for the appearance of the crystalline structure are discussed in detail.

537.525 **3577**

The Behaviour of Electron-Ion Plasma in Magnetic Fields.—G. V. Spivak & O. N. Repkova. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 5, pp. 275–279. In Russian.) The following effects of magnetic fields on the electron-ion plasma were investigated experimentally : (*a*) The variation in the concentration of charged particles in a magnetic field symmetrical with respect to the axis. Curves are plotted in Fig. 1 for various discharge currents (from 0.1 to 1.2 A) through mercury vapour in a " quasi-uniform " magnetic field, and in Fig. 2 for discharge currents of 100 and 400 mA through mercury vapour in the field of a magnetic lens. (*b*) The variation in the average electron energy. A curve is plotted in Fig. 3. (*c*) The variation in the electron distribution. The curve plotted in Fig. 4 refers to discharges through neon between two coaxial cylinders.

537.525 : 621.3.015.532 **3578**

The Variation of the Mobility of Negative Ions in Strong Electric Fields and the Role of This Phenomenon in Corona Discharges.—N. A. Kaptsoff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 5, pp. 280–285. In Russian.) Experiments were conducted to explain the contradiction existing between the accepted values of K for the mobility of negative ions in humid air, and experimental values derived from volt-ampere characteristics of the corona discharge between two coaxial cylinders. The circuit used in these experiments is a simplified version of those proposed by Tyndall (1929 Abstracts, p. 146) and Van de Graaf (1928 Abstracts, p. 525) and the results obtained are plotted in Fig. 4. The contradiction is ascribed to the fact that the table values of K are given for values of E lower than those normally met in the case of corona discharges, and that complex ions are formed in humid air with these lower values of E.

An abstract in English was noted in 1814 of July.

537.525.3 : 621.316.722.078.3 **3579**

Characteristics of the Pre-Corona Discharge and Its Use as a Reference Potential in Voltage Stabilizers.—Brown. (*See* 3758.)

537.53 **3580**

Spontaneous Emission Probabilities at Radio Frequencies.—E. M. Purcell. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 681.) Summary of Amer. Phys. Soc. paper.

537.533 : 621.385.833 **3581**

Extraction of Electrons by an Electric Field.—P. I. Lukirski. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 5, pp. 226–231. In Russian.) A survey of literature on the Fowler-Nordheim theory of the electron emission from metals under the action of a strong electric field. Some of the experimental results obtained in Russia are also discussed.

An abstract in English was noted in 1952 of July.

537.591.8 **3582**

Production of Mesons by Electrons.—H. Feshbach. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 690.) Summary of Amer. Phys. Soc. paper.

538.569.4 + 621.396.11].029.64 : 551.57 **3583**

Absorption of Microwaves by Water Vapor.—Autler, Becker & Kellogg. (*See* 3719.)

538.569.4.029.64 **3584**

Absorption of Microwaves by Gases : Part 2.—J. E. Walter & W. D. Hershberger. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 694.) " The absorption coefficients and dielectric constants of sixteen gases have been measured at the two wavelengths $\lambda = 1.24$ cm and $\lambda = 3.18$ cm. The gases are H_2S, SO_2, COS, $(CH_3)_2O$, C_2H_4O, NH_3, six halogenated methanes, and three amines." For part 1 see 3234 of November. Summary of Amer. Phys. Soc. paper.

538.569.4.029.64 : [534 + 536 **3585**

Thermal and Acoustic Effects attending Absorption of Microwaves by Gases.—W. D. Hershberger. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 695.) " The conversion of microwave energy into thermal and acoustic energy by the use of any of the gases which absorb microwaves is described. . . A gas-filled resonator capable of detecting 10 milliwatts of microwave power is described which consists of a cavity which resonates electrically to the microwave frequency and acoustically to the modulating frequency." Summary of Amer. Phys. Soc. paper.

539.16.081 **3586**

New Units for the Measurement of Radioactivity.—E. U. Condon & L. F. Curtiss. (*Rev. sci. Instrum.*, June 1946, Vol. 17, No. 6, p. 249.)

539.389.3 : 536.7 **3587**

Thermodynamics of Relaxation Processes.—G. E. Kimball. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 688.) Summary of Amer. Phys. Soc. paper.

541.13 **3588**

Physical Interaction of Electrons with Liquid Dielectric Media. The Properties of Metal-Ammonia Solutions.—R. A. Ogg, Jr. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, pp. 668–669.) A discussion in terms of quantum mechanics. The electrical and magnetic properties of such solutions are explained.

621.3.011.2 + 621.3.011.5] : 546.3[-13 + -14 **3589**

On the Relationship between the Liquid and Gaseous States in Metals.—Ya. Zel'dovich & L. Landau. (*Zh. eksp. teor. Fiz.*, 1944, Vol. 14, Nos. 1/2, pp. 32–34. In Russian.) It is pointed out that even at absolute zero there is a definite difference between a metal and a dielectric, and that a transition from one state into another can only be effected with emission or absorption of latent heat and an abrupt change in the properties of the material. A similar question of the transition from a metallic liquid state into a dielectric gaseous state is then examined, and the conclusion reached is that there should exist a non-metallic liquid phase which changes abruptly into a metal, when pressure increases, or into a gas, when pressure decreases.

621.314.63 : 539.233 **3590**

Contact Potential Difference as a Tool in the Study of Adsorption.—R. C. L. Bosworth. (*J. roy. Soc. N.S.W.* of 1945, 19th June 1946, Vol. 79, Part 2, pp. 53–62.) A description of apparatus for using the contact potential difference method to measure the work function of a surface and an account of its application to the study of the properties of electro-positive and electro-negative films and to the measurement of vapour pressures.

621.314.632 **3591**

Theory of Crystal Rectifiers.—Sachs. (*See* 3629.)

621.314.632.029.6 **3592**

High Frequency Rectification Efficiency of Radar Crystal Detectors.—Lawson, Goodman & Schiff. (*See* 3636.)

621.317.332 : 537.312.62 **3593**

High-Frequency Resistance of Superconductors.—A. B. Pippard. (*Nature, Lond.*, 17th Aug. 1946, Vol. 158, No. 4007, pp. 234–235.) Measurements have been made in the temperature range 2–4.2°K on mercury and polycrystalline tin using the specimen to form a twin, separately shielded, quarter-wave transmission line. The measured specific conductivity for tin at 3.8°K in the region of 1 200 Mc/s is about one seventh the d.c. value. These results, together with some obtained in the presence of a superposed constant magnetic field, are related to those of previous observers (See especially 208 of 1941).

621.384.2 **3594**

The Technique of Gamma Radiography.—R. Halmshaw. (*Engineering, Lond.*, 23rd Aug. 1946, Vol. 162, No. 4206, pp. 169–170.)

621.386.77 **3595**

Secondary Radiation from X-Ray Filters.—N. M. Morrow. (*Canad. J. Res.*, July 1946, Vol. 24, Sec. A, No. 4, pp. 46–55.)

537(075) **3596**

Principles of Electricity Illustrated. [Book Review]—R. C. Norris. Odhams Press, London, 380 pp., 8s. 6d. (*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, p. 293.)

538.1 **3597**

Le Magnétisme. Vol. 1 : Généralités et Magnéto-Optique ; Vol. 2 : Ferromagnétisme ; Vol. 3 : Paramagnétisme. [Book Notice] — Collection Scientifique, Institut International de Coopération Intellectuelle, Paris ; Columbia Univ. Press, U.S.A., 1940, 184 + 280 + 348 pp., $2.00 + $2.50 + $2.50. (*Science*, 26th July 1946, Vol. 104, No. 2691, pp. 70–73.) Report by S. J. Barnett on the proceedings of an international conference on magnetism held in Strasbourg in 1939 under the presidency of Prof. Weiss, the volumes constituting a wide survey of current magnetic research and summaries of earlier work.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.16 : 621.396.822 **3598**

Interpretation of Cosmic Noise—Radio Waves from Extraterrestrial Sources.—C. H. Townes. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 695.) Assuming cosmic noise is due to radiation from interstellar ions of density n and at temperature T, the effective temperature of the Milky Way is found to depend on frequency ν as

$$Ta = T\left[1 - \exp\left(-8 \times 10^{-8}\frac{n^2S}{\nu^2}\right)\right]$$

where S is the distance from the observer to the Milky Way boundary in the direction of observation. This gives qualitative agreement with some of the observational data. Summary of Amer. Phys. Soc. paper.

523.165 : 621.396.822 **3599**

Fluctuations in Cosmic Radiation at Radio-Frequencies.—J. S. Hey, S. J. Parsons & J. W. Phillips. (*Nature, Lond.*, 17th Aug. 1946, Vol. 158, No. 4007, p. 234.) Continuation of experiments referred to in 3270 of November. "Short period [order of several seconds] irregular fluctuations have been found to be associated with the direction of Cygnus. . . . The average amplitude of the fluctuations is 15% of the mean power received." The source appears to subtend an angle not exceeding 2°. A brief discussion of the significance of the results is given.

537.591.5 **3600**

Production of Mesotrons in the Stratosphere.—I. Bloch. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, pp. 575–585.) Theoretical derivation of the intensity of the penetrating cosmic-ray particles as a function of altitude, magnetic latitude and energy, assuming mesotrons to be produced in multiples by primary protons in fields of atomic nuclei.

537.591.8 **3601**

The Ionization Spectrum of Cosmic-Ray Electrons and Mesotrons.—P. B. Weisz & W. F. G. Swann. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 690.) The average ionization produced by mesotrons was found experimentally to be about 68% of that produced by electrons, but the experimental spread in values is unexpectedly large. Summary of Amer. Phys. Soc. paper.

538.71 : 629.123.011.22 **3602**

Measurement of Magnetic Fields beneath Ships.—H. A. Miller. (*J. R. Soc. Arts*, 12th April 1946, Vol. 94, No. 4715, pp. 327–329.) A comparison of the magnetic field existing beneath a ship in England and at a measurement range constructed off Colombo Harbour in the region of the magnetic equator.

550.34 : 534.2 **3603**

Studies on Seismic Waves: Part 1—Reflection and Refraction of Plane Waves. Part 2—Rayleigh Waves in a Superficial Layer.—Fu. (*See* 3565.)

551.51.053.5 : 621.396.11 **3604**

Short-Wave [ionospheric] **Forecasting.**—Bennington. (*See* 3721.)

LOCATION AND AIDS TO NAVIGATION

534.417 : 534.88 **3605**

Echo Ranging Sonar [model QCS/T].—R. J. Evans. (*Electronics*, Aug. 1946, Vol. 19, No. 8, pp. 88–93.) A device for accurate location of underwater targets. A principle analogous to radar is employed, with pulses of sound energy: echoes are received from obstacles. Frequencies employed are in the range 10 kc/s to 30 kc/s. A 600-W pulse of 0.1 to 0.2 seconds duration is transmitted at intervals of several seconds by a self-excited oscillator and amplifier feeding a magnetostriction projector-receiver, housed in a dome under the ship. Receiving equipment comprises a superheterodyne receiver, a range indicator and a loudspeaker for providing an audible signal. Each of these units is described in detail with block and circuit diagrams.

621.396.7 : 621.396.9 **3606**

Decca Navigator Stations.—M. G. Scroggie. (*Wireless World*, Aug. 1946, Vol. 52, No. 8, pp. 260–262.) The essential requirement of the service is the maintenance over the whole of its area of a phase pattern that is stationary and permanent. In order that the two interfering wave trains may be separately received, for purposes of phase checking, the transmissions are on two exact submultiples of the phase comparison frequency; one of a pair (or more) of transmitting stations provides the master drive for the others, thus ensuring relative frequency constancy, while a receiver automatically corrects the phase of one of each pair of transmissions. See also 1242 of May and back reference.

621.396.9 **3607**

Factors affecting the Range of Radar Sets.—L. R. Quarles & W. M. Breazeale. (*Trans. Amer. Inst. elect. Engrs*, Aug./Sept. 1946, Vol. 65, Nos. 8/9, pp. 546–548.) The relation between received and transmitted powers is derived for the case of transmitting and receiving aerials fitted with parabolic reflectors, in terms of the wavelength, power gain of the aerials, and the range and effective area of the target. By considering the magnitude of the thermal agitation noise in the receiver, an expression is obtained for the maximum range at which an echo is detectable. The formula is discussed and illustrated by a numerical example. A brief discussion is given of the nature of the polar diagram of aerials using parabolic reflectors.

621.396.9 **3608**

Navigating by Loran.—C. J. Pannill. (*Telegr. Teleph. Age*, Sept. 1946, Vol. 64, No. 9, pp. 17–18.) A brief account of experiences on the liner Drottningholm during a voyage from New York to Shanghai. Dependable ranges of 700 miles by day and 1 400 miles by night were obtained.

621.396.9 **3609**

Successor to the Sextant.—H. Manchester. (*Sci. Amer.*, June 1946, Vol. 174, No. 6, pp. 264–267.) An elementary account of Loran.

621.396.9 **3610**

Radar.—E. Aisberg. (*Cah. toute la Radio*, Sept. 1945, No. 3, pp. 5–12.)

621.396.9 : 621.396.932 **3611**

Metrovick Marine Radar Set.—Metropolitan-Vickers Electrical Co. (*Engineering, Lond.*, 26th July 1946, Vol. 162, No. 4202, pp. 79–80; *Wireless World*, Aug. 1946, Vol. 52, No. 8, p. 269.) A production model, type MR1, which consists of three units: (1) a console containing the receiver, p.p.i., timebase strobe unit, control panel, power unit, and modulator; (2) the transmitter proper, signal mixer, head amplifier and mixer, i.f. amplifier, and discriminator circuit for a.f.c.; (3) the aerial unit of parabolic "cheese" type, normally driven at 20 r.p.m. and mounted in a perspex dome.

The frequency is 9 500 Mc/s with a peak power of 50 kW, $\frac{1}{4}$-μs pulses are used with a repetition rate of 1 000 per sec. Three ranges are provided: 3 000 yd, 10 000 yd, and 60 000 yd; the p.p.i. displays obstructions as near as 50 yd, and an audible warning signal is incorporated.

621.396.9 : 621.396.932 **3612**

Navigational Radar in Merchant Ships.—E. D. Hart. (*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, pp. 265–267.) A detailed description of modified naval radar equipment, demonstrated on H.M.S. Fleetwood. See also 1246 and 1247 of May.

621.396.9 : 621.397 **3613**

Has Radar influenced Television Development?—(*See* 3799.)

621.396.9 : 623.454.25 **3614**

Radio Proximity Fuze Design.—Hinman & Brunetti. (*See* 3713.)

621.396.932.25 **3615**

Auxiliary Pilot guides Ships.—J. H. Jupe. (*Electronics*, Aug. 1946, Vol. 19, No. 8, pp. 154..160.) A buoyant tank containing radar receiving and transmitting equipment is placed in position by a skilled navigator. The circuit consists basically of a supersonically quenched r.f. amplifier (made to oscillate for transmitting) with a demodulator and pulse amplifier. A pulse signal from a ship-borne interrogator is received and returned greatly amplified. On immersion, power supplies are connected automatically and the buoy is armed for self-destruction.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788.7 **3616**

A Sensitive Vacuum Gauge with Linear Response.—J. R. Downing & G. Mellen. (*Rev. sci. Instrum.*, June 1946, Vol. 17, No. 6, pp. 218–223.) Ionization gauge for measuring pressures in the range between zero and 10 mm Hg, with linear response.

531.788.7 **3617**

A Radium Source Ion Gauge.—G. L. Mellen. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 691.) For measurement of pressures between 1 μ and 10 mm. Summary of Amer. Phys. Soc. paper.

533.5 : 621.3.032.53 **3618**

Glass-to-Metal Seal Design.—W. J. Scott. (*J. sci. Instrum.*, Sept. 1946, Vol. 23, No. 9, pp. 193–202.) The physics and chemistry of "oxide" and other seals are discussed from a theoretical and practical standpoint. Particular attention is paid to the formation of cracks and a nomogram correlates stress, strain and glass thickness. The relevant physical properties of various glasses and metals are tabulated. Excerpts from this paper were noted in 97 of January.

549.514.51 : 534.321.9 **3619**

Refinements in Supersonic Reflectoscopy. Polarized Sound.—Firestone & Frederick. (*See* 3515.)

535.215.1 : 546.28 **3620**

The Velocity of Propagation of the Transmitted Photo-Effect in Silicon Crystals.—F. C. Brown. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 686.) The relative magnitude of the transmitted effect is a function of the velocity, coefficient of recapture and distance travelled. The velocity, measured directly for distances of travel from 0.4 cm to 1 cm is 400 m/sec ± 5%. Summary of Amer. Phys. Soc. paper.

535.37 **3621**

Corpuscular *vs.* Undulatory Excitation of Phosphors.—H. W. Leverenz. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 686.) Summary of Amer. Phys. Soc. paper.

535.37 : 535.61–15 **3622**

Some Properties of Infra-Red Sensitive Phosphors.—R. T. Ellickson. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, pp. 685–686.) Alkaline earth sulphides and selenide phosphors activated with rare earths show a marked increase in phosphorescence under infra-red stimulation. Summary of Amer. Phys. Soc. paper.

537.226.8 : 621.319.4 **3623**

Temperature Coefficients of Interfacial Polarization in Dielectrics.—R. F. Field. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 688.) Summary of Amer. Phys. Soc. paper.

541.147.4 : 546.683.22 **3624**

The Photoelectric Mechanism of the Thallous Sulfide Photo-Conductive Cell.—A. von Hippel, F. G. Chesley, H. S. Denmark, P. B. Ulin & E. S. Rittner. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 685.) Thermoelectric measurements show that pure thallous sulphide is "an 'excess' semiconductor changing to a 'defect' conductor on oxidation". The photo-sensitization of thallous sulphide is due to the presence of oxygen. Summary of Amer. Phys. Soc. paper.

546.431.826 : 621.3.011.5 **3625**

Oscillographic Study of the Dielectric Properties of Barium Titanate.—A. de Bretteville, Jr. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 687.) Barium titanate and solid solutions of barium and strontium titanates exhibit saturation of the dielectric flux density with increasing field strength. These properties have been studied by an oscillograph method throughout the charging and discharging cycle. Summary of Amer. Phys. Soc. paper.

546.45 : 669.018 **3626**

Beryllium : Workaday Metal.—F. P. Peters. (*Sci. Amer.*, June 1946, Vol. 174, No. 6, pp. 249–251.) A non-technical account of its principal properties and uses as an alloying metal.

549.514.51 **3627**

Recrystallization of Quartz as a Result of Flexure.—D. D'Eustachio. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 687.) Quartz crystals change from single crystals to a "poly-crystalline" structure when they are thinner than $25\,\mu$ but after cold working appear to recrystallize. See also 3310 and 3311 of November. Summary of Amer. Phys. Soc. paper.

621.314.632 **3628**

Rectification Series.—W. H. Brattain. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 682.) Rectification takes place between one crystal and another on which a point has been made. Using the pointed crystal as reference, a series may be made such that any crystal in it will rectify in one direction with those above it and in the other direction with those below it. Summary of Amer. Phys. Soc. paper.

621.314.632 **3629**

Theory of Crystal Rectifiers.—R. G. Sachs. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 682.) The observed d.c. characteristics of Ge and Si rectifiers agree approximately with those calculated on the multi-contact theory which assumes that (1) the contact potential ϕ varies continuously over the surface of contact, (2) the total current is the sum of the partial currents flowing through regions of varying ϕ, (3) the area of a region with a contact potential ϕ may be a function of ϕ, and (4) the number of spots having contact potential between ϕ and $\phi + d\phi$ is a function of ϕ. Summary of Amer. Phys. Soc. paper. See also 3630 and 3633.

621.314.632 **3630**

Semi-Quantitative Explanation of D.C. Characteristics of Crystal Rectifiers.—V. A. Johnson, R. N. Smith & H. J. Yearian. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 682–683.) "The multi-contact theory is employed to explain the observed d.c. current-voltage characteristics between metal and semi-conductor (Ge and Si) . . . The proper slopes are obtained for the forward current." A graphical method is developed for the rapid synthesis of any characteristic. Summary of Amer. Phys. Soc. paper. See also 3629 and 3633.

621.314.632 **3631**

Contact Capacity of Crystal Rectifiers.—R. N. Smith. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 683.) The capacitance is measured indirectly from the decrease of rectification efficiency at microwave frequencies assuming that the crystal can be represented by a "spreading" resistance in series with a parallel combination of capacitance and the nonlinear contact resistance, these elements being independent of frequency. The dependence of capacitance on d.c. bias is in agreement with theory for silicon crystals but not for germanium units. Summary of Amer. Phys. Soc. paper.

621.314.632 **3632**

Image Force and Tunnel Effect in Crystal Rectifiers.—E. D. Courant. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 684.) The divergence of the experimental *i-V* curve from the theoretical (equation given) is explained by assuming that the height of the potential barrier is reduced by the image force, and that some electrons tunnel through the barrier. Summary of Amer. Phys. Soc. paper.

621.314.632 : 546[.28 + .289 **3633**

D.C. Characteristics of Ge and Si Crystal Rectifiers.—H. J. Yearian. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 682.) The slope of the *i-V* characteristic is less than that predicted. A consideration of the difficulties in explaining the discrepancy. Summary of Amer. Phys. Soc. paper. See also 3629 and 3630.

621.314.632 : 546.289 **3634**

High Voltage and Photo-Sensitive Characteristics in Germanium.—S. Benzer. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 683.) Photo-effects of two types are observed in the visible and near infra-red range: (1) a saturated *i-V* characteristic in which the saturation current varies with illumination and temperature, and (2) a triple-valued characteristic with a voltage peak and negative resistance region. Some Ge rectifiers can withstand high inverse voltages. Summary of Amer. Phys. Soc. paper.

621.314.632 : 546.289 **3635**

Effect of Various Atmospheres on Germanium Crystal Rectifiers.—R. M. Whaley & K. Lark-Horovitz. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, pp. 683–684.) Relatively high-purity germanium which provided poor rectification in a vacuum was unchanged by admission of gas. Samples of relatively high conductivity, due to impurity content, which gave good rectification in vacuum, showed irreversible increases in back resistance upon admitting air. The changes can be accounted for by multi-contact theory. Summary of Amer. Phys. Soc. paper.

621.314.632.029.6 **3636**

High Frequency Rectification Efficiency of Radar Crystal Detectors.—A. W. Lawson, B. Goodman & L. I. Schiff. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 682.) If a finite time is required to ionize the semiconductor donator levels in the blocking layer, the rate of decrease of efficiency with frequency may be explained. Summary of Amer. Phys. Soc. paper.

621.314.632.029.6 **3637**

Noise in Radar Crystal Detectors.—Schiff. (*See* 3725.)

621.315.59 **3638**

The Effect of Grain Structure on the Electrical Conductivity of Semiconductors.—B. Goodman. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 687.) Only the effect due to the discontinuities introduced into the periodic lattice potential is considered. The added resistivity may sometimes be comparable with that part of the room temperature resistance due to lattice vibrations, but it is small compared with the total resistivity which is mostly caused by the impurity ions. Summary of Amer. Phys. Soc. paper.

621.315.61 : 546.4 **3639**

Materials with High and Super-High Permittivities.—B. M. Vul. (*Elektrichestvo*, 1946, No. 3, pp. 12-17. In Russian.) Experimental investigation of titanates of metals in the second group of Mendeleeff's table. It is shown that a barium titanate can be used as an electrical insulating material with a permittivity exceeding 1 000.

621.315.612 : 621.319.4.029.5 **3640**

High Frequency Ceramic Capacitors.—Vul & Skanavi. (*See* 3779.)

621.315.616 **3641**

Synthetic Rubbers and Plastics: XI. (Part 3) Water and the High Polymer.—F. T. White. (*Distrib. Elect.*, Oct. 1946, Vol. 19, No. 164, pp. 170–173.) A discussion on moisture permeability, and the effect of including plasticisers, resins, or waxes in the basic materials. For part 2 (Section XI) see 2936 of October.

621.315.616 : 621.38/.39 **3642**

Plastics in the Electronic and High Frequency Industries.—W. S. Penn. (*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, pp. 280–281.) Improvements and future possibilities. Tables give properties of dielectrics of various types.

621.315.616.9 : 621.3 **3643**

Plastics and the Electrical Industry: Parts 1-4.—P. R. S. Gibson. (*Electrician*, 16th Aug.–6th Sept. 1946, Vol. 137, Nos. 3559–3562, pp. 443–445, 517–520, 582–585 & 649–652.) In part 1 the conductivity, dielectric strength, permittivity and power factor of plastic insulating materials in general are defined and discussed; in subsequent parts the properties and uses of specific materials are described.

621.318.22 : 620.179.14 **3644**

Magnetic Testing of [ferromagnetic] **Metals.**—P. E. Cavanagh, E. R. Mann & R. T. Cavanagh. (*Electronics*, Aug. 1946, Vol. 19, No. 8, pp. 114–121.) The examination of the metallurgical properties of metals by testing their magnetic qualities. An extensive description of the technique with practical details and applications is given.

621.383.4 + 535.215.1 : 546.28 **3645**

A New Bridge Photo-Cell employing a Photo-conductive Effect in Silicon. Some Properties of High Purity Silicon.—Teal, Fisher & Treptow. (*See* 3784.)

621.396.611.21.032.2 : 546.59 **3646**

Gold Film Electrodes for High Frequency Quartz Plates.—Spears. (*See* 3794.)

669.45.778 : 621.315.22 **3647**

F-3 Lead Alloy — an Improved Cable Sheathing.—L. F. Hickernell & C. J. Snyder. (*Trans. Amer. Inst. elect. Engrs*, Aug./Sept. 1946, Vol. 65, Nos. 8/9, pp. 563–569.) Details of a new arsenical lead alloy for cable sheathing, including chemical composition and physical properties. It is superior to materials hitherto used for power cables, notably in respect of its increased resistance to bending fatigue, creep resistance, and bursting strength.

621.315.614.72 **3648**

Varnished Cloths for Electrical Insulation. [Book Review]—H. W. Chatfield & J. H. Wreddon.

J. & A. Churchill, London, 1946, 255 pp., 21s. (*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, p. 292.) A "clear and orderly exposition of the technical features of varnished fabrics . . . The properties of the finished products . . . are very fully dealt with."

621.315.616 **3649**
Collection "Matériaux de Synthèse". Aminoplastes. [Book Review]—P. Talet. **Résines Vinyliques.** [Book Review]—H. Gibello. Dunod, Paris, 280 fr. & 260 fr. (*Engineering, Lond.*, 23rd Aug. 1946, Vol. 162, No. 4206, p. 171.)

MATHEMATICS

517.432.1 **3650**
Some Notes on the Operational Calculus.—L. Jofeh. (*J. Brit. Instn Radio Engrs*, March/May 1946, Vol. 6, No. 2, pp. 73–77. Discussion, pp. 77–79.) A short review is given of the various systems of operational calculus and the Heaviside system is discussed in greater detail. The basis of the operational form of a differential equation is explained and the interpretation of the operational equation illustrated by an example. A bibliography of 14 items is given.

517.512.2 **3651**
Fourier Series.—M. M. Levy. (*J. Brit. Instn Radio Engrs*, March/May 1946, Vol. 6, No. 2, pp. 64–73.) An outline of Fourier analysis and its application to the study of periodic and non-periodic functions. Fourier series are given in trigonometrical and exponential form, and simplified forms derived which are applicable to periodic curves having various types of symmetry. Expressions are given for obtaining the coefficients of the series from the discontinuities in a periodic curve. The theory is extended to the treatment of non-periodic functions such as the unit pulse and unit impulse functions, and the response of a low-pass filter to a pulse of given width is determined. Brief mention is made of the harmonic analysis of periodic functions with special reference to methods of determining very high harmonic components.

517.942.82 : 621.3.014/.015].33 **3652**
Switching Problems and Instantaneous Impulses.—Jaeger. (*See* 3550.)

518.2 **3653**
Mathematical Tables.—(*Bur. Stand. J. Res.*, July 1946, Vol. 37, No. 1, p. 73.) A list of mathematical tables made available through the National Bureau of Standards, including powers of integers, exponentials, circular functions and associated integrals, logarithms, and probability functions.

518.4 : 676.31 **3654**
Utility of Log-Log *vs* Arithmetic Co-Ordinate Grids.—A. A. Merrill. (*Gen. elect. Rev.*, July 1946, Vol. 49, No. 7, pp. 20–22.)

518.5 : 621.385.001.8 **3655**
Electronic Computers.—W. Shannon. (*Electronics*, Aug. 1946, Vol. 19, No. 8, pp. 110–113.) The fundamental circuits for performing elementary mathematical calculations electrically are described, with brief remarks on the military and industrial use of electrical computers.

534 + 537].014.2 : 518.61 **3656**
On the Numerical Treatment of Forced Oscillations.—A. C. Sugar. (*Quart. appl. Math.*, July 1946, Vol. 4, No. 2, pp. 193–196.) An approximation to the Duhamel integral is used as the solution of the differential equation of a harmonic oscillator. Vector methods are used to deduce the maximum displacement and acceleration.

536.21 : 517.942.9 **3657**
Heat Conduction in Elliptical Cylinder and an Analogous Electromagnetic Problem.—McLachlan. (*See* 3570.)

621.396.679.4.012.2 **3658**
Solving Feeder Problems Graphically.—Kelley. (*See* 3549.)

516 + 517 **3659**
Analytical Geometry and Calculus. [Book Review]—H. B. Phillips. J. Wiley, New York: Chapman & Hall, London, 2nd edn, 504 pp., 27s. (*J. sci. Instrum.*, Sept. 1946, Vol. 23, No. 9, p. 218.) For courses in science and engineering.

518.2 **3660**
An Index of Mathematical Tables. [Book Review]—A. Fletcher, J. C. P. Miller & L. Rosenhead. Sci. Computing Service, London, 1946, 451 pp., 75s. (*Nature, Lond.*, 24th Aug. 1946, Vol. 158, No. 4008, pp. 252–253.) See also 3339 of November.

MEASUREMENTS AND TEST GEAR

531.71 + .76] : 621.383 **3661**
A Photoelectric Method of Indicating Small Displacements and of Timing a Moving Body.—D. S. Perfect & R. M. J. Withers. (*J. sci. Instrum.*, Sept. 1946, Vol. 23, No. 9, pp. 204–207.)

531.76 **3662**
The Measurement of Ultra-Short Time Differences.—S. H. Neddermeyer. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 702.) A device ("chronotron") which uses a bent coaxial line to produce superposition of pulses whose time interval is being measured. Accuracy to $\pm 3.10^{-11}$ sec is claimed. Summary of Amer. Phys. Soc. paper.

531.76 : 621.317.755 **3663**
A Note on the Measurement of Pulse Duration by Anode-Current Form-Factor.—L. H. Ford. (*J. sci. Instrum.*, Sept. 1946, Vol. 23, No. 9, p. 216.) Pulse shape is intermediate between a rectangle and a triangle. In the former case pulse duration t is given by $t = T/F^2$ and in the latter by $t = 1.33T/F^2$, where T is the pulse-recurrence time and F the ratio of r.m.s. (measured thermally) to mean value of oscillator-anode current supply. The assumption of a perfect rectangle will give durations too small by not more than 10%.

In an experimental verification the results were compared with those obtained using a c.r.o. over a range of pulse width 2–1 000 μs and pulse recurrence 50–5 000 μs. Agreement was within 5%.

538.214 : 621.317.44 **3664**
An Electrodynamic Balance for the Measurement of Magnetic Susceptibilities.—T. S. Hutchison & J. Reekie. (*J. sci. Instrum.*, Sept. 1946, Vol. 23, No. 9, pp. 209–211.) The magnetic forces are compensated by passing known currents through a coil system. The balance is directly calibrated and can measure forces as low as a few hundredths of a dyne to an accuracy of about ¼%.

539.16.08 : 537.591.8 **3665**

Fluctuations in Measurements of Ionization per Centimeter of Path in Proportional Counters.—W. F. G. Swann. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 690.) Summary of Amer. Phys. Soc. paper.

621.317.33 **3666**

Measuring Mutual Inductance and Capacitance.—A. W. Simon. (*Electronics*, Aug. 1946, Vol. 19, No. 8, pp. 142 . . 154.) The method used "is based on the Campbell modification of the Felici circuit. . . It is particularly suitable for the accurate measurement of mutual inductance between coils with small coefficients of coupling such as are frequently encountered in radio work . . ." Measurements of intercoil capacitances can also be made.

621.317.333 **3667**

Measuring Insulation Resistance.—J. Piggott. (*Wireless World*, Aug. 1946, Vol. 52, No. 8, pp. 263–264.) The model 40 and model 7 "Avometers" are fitted with an automatic cut-out which requires the use of a protective rectifier. The circuit thus formed with the inductance of the moving coil of the instrument resonates at about 450 kc/s. If this frequency is picked up it may be rectified and produce false readings.

621.317.333.027.3 **3668**

High Voltage D.C. Testing of Rubber-Insulated Wire.—W. N. Eddy & W. D. Fenn. (*Trans. Amer. Inst. elect. Engrs*, Aug./Sept. 1946, Vol. 65, Nos. 8/9, pp. 576–578.) The results of experiments on the limits suitable for the high voltage d.c. testing of plain insulated wire immersed in water.

621.317.7.017.5 **3669**

Instrument Bearing Friction.—A. L. Nylander. (*Gen. elect. Rev.*, July 1946, Vol. 49, No. 7, pp. 12–17.) Formulae are given for computing the bearing-system frictional torque in instruments requiring high sensitivity (e.g. microammeters). To reduce this torque, minimum pivot radius, maximum jewel-radius and minimum end-play consistent with small side-play error are required.

621.317.715.085.39 **3670**

A Simple Galvanometer Amplifier with Negative Feedback.—J. S. Preston. (*J. sci. Instrum.*, Aug. 1946, Vol. 23, No. 8, pp. 173–176.) An intense beam of light reflected from the mirror of an ordinary d'Arsonval galvanometer is focused on a pair of selenium rectifier photocells connected in series opposition, the net current from which is measured by a secondary galvanometer. Negative feedback is introduced by interconnexion of the two galvanometer circuits to give a more linear overall response, and a sensitivity less influenced by changes in individual elements. A red-absorbing filter is used in the light beam to eliminate photocell fatigue. Sufficient gain is obtained without valve amplification to give an overall sensitivity of 15–20 metres/μA with zero repetition to 10^{-10}A.

537.2 : 621.317.72 **3671**

The Investigation of Electrostatic Fields by means of a Valve Voltmeter.—Street. (*See* 3572.)

621.317.72 : 621.384.6 **3672**

A Megavoltmeter for Induction Electron Accelerators.—W. F. Westendorp. (*Rev. sci. Instrum.*, June 1946, Vol. 17, No. 6, pp. 215–217.)

621.317.725 : 621.385 **3673**

Inverse Vacuum-Tube Voltmeter.—S. H. Dike. (*Electronics*, Aug. 1946, Vol. 19, No. 8, pp. 140, 142.) Specially designed for measuring high voltages and maintaining a high input impedance. Calibration curves and a circuit diagram are given.

621.317.725 : 621.385 **3674**

Valve Voltmeters.—F. Haas. (*Cah. toute la Radio*, Sept. 1945, No. 3, pp. 18–20.)

621.317.726 **3675**

Fighting Vehicle Exhibition.—(*Engineer, Lond.*, 16th Aug. 1946, Vol. 182, No. 4727, pp. 148–149.) Includes description of a battery-operated peak voltmeter designed for the measurement of sparking-plug voltages. It is basically a resistance potential divider followed by a triode rectifier with a milliammeter in the anode, calibrated directly in kilovolts.

621.317.738 **3676**

Increasing the Sensitivity of the Schering Bridge for the Measurement of Small Loss Angles at Low Voltage.—G. Sella. (*Alta Frequenza*, March 1946, Vol. 15, No. 1, pp. 15–27. With English, French and German summaries.) A push-pull preamplifier is inserted between the bridge and the output transformer in such a way as to preserve symmetry to earth; balance adjustments are provided on one of the values by a variable cathode resistor and a variable capacitance from anode to earth. The effective amplification at 50 c/s is roughly unity and the asymmetry is about 5.10^{-5}. The preamplifier is followed by a two-stage amplifier feeding a bridge-type copper-oxide rectifier connected to a d.c. amplifier. Tests show that at 50 c/s loss angles of 10^{-5} can be measured to 5% even with a test capacitance of 50 $\mu\mu$F.

621.317.755 **3677**

Elements of a New Oscilloscope Design.—E. C. Simmons. (*Electronic Industr.*, Sept. 1946, Vol. 5, No. 9, pp. 96–97 . . 118.) Design features of a commercial oscillograph for general laboratory use. A variety of timebases and synchronizing arrangements are considered. A calibration circuit for the determination of input signal amplitude is also included, together with a pulse generator for triggering external circuits.

621.317.761.029.62/.64 **3678**

The Determination of Very High Frequencies.—F. Dickson. (*Proc. Instn Radio Engrs, Aust.*, July 1946, Vol. 7, No. 7, p. 20.) "Fundamentally, the method is to determine two or more relatively low frequencies, the harmonics of which are related to the frequency to be checked in such a way that the latter is the l.c.m. of the observed frequencies", *i.e.* $F = nf_1 = (n - 1)f_2$ etc. For a suitable instrument see 679 of March.

621.317.763.029.62/.63 **3679**

Frequency Measurements at U.H.F.—R. Endall. (*Radio News*, Sept. 1946, Vol. 36, No. 3, pp. 50–52 . . 100.) Description of types of wavemeter available for amateur use in the range 100–3 000 Mc/s, including absorption wavemeters, butterfly types, Lecher wire systems, and heterodyne frequency meters.

621.317.763.029.62 **3680**

A Wavemeter for the Ultra-Short Band.—J. Banner. (*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, pp. 268–269.) A compact, robust instrument, with frequency coverage 155–255 Mc/s and accurate to within ±0.25 Mc/s. Provision is made for use as a signal generator.

621.317.784.029.4 **3681**

Hypso-Wattmeter [variable-impedance output meter]**.**—C. M. Laurent. (*Cah. toute la Radio*, Oct. 1945, No. 4, pp. 9–11.) Compares the power outputs of amplifiers or receivers up to 20 W with a reference power of 1 mW, at frequencies between 30 and 20 000 c/s. Design details are given.

621.317.79 : 621.396.619 **3682**

The Time-Delay [amplitude] **Modulation Meter, TH 3077.**—M. Sollima. (*Rev. tech. Comp. franç. Thomson-Houston*, Jan. 1944, No. 1, pp. 45–58.) A brief discussion of various types of meter for measuring modulation depth ; the advantages of incorporating a time delay (described in French Patent 858 680) to give a suitable measure of peak values with small error are stated. A description of the TH 3077 includes details of circuit design. The l.f. amplifier is provided with negative feedback which does not function until the input level exceeds a certain value. The peak voltmeter is followed by a logarithmic d.c. network using three biased diodes enabling a nearly linear decibel scale to be obtained over range of 50 db. The error of measurement is less than 1 db for frequencies of 30–15 000 c/s.

621.385.832.088 **3683**

C.R. Tube Quality Measuring Apparatus.—A. M. Spooner. (*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, pp. 273–276 ; *J. Televis. Soc.*, June 1946, Vol. 4, No. 10, pp. 251–254.) Circuits are described for the determination of distortion in either magnetically or electrostatically deflected television tubes, and in their associated timebases. Pulses, synchronized to the line and frame frequencies, are fed to the picture grid to produce on the screen an array of dots. The defocusing and asymmetrical spacing of the dots give an indication of faulty circuits. Variation of spot size with peak beam-current may also be determined.

621.396.67.08.011.2 **3684**

Antenna Impedance Measurement.—D. D. King. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 696.) Summary of Amer. Phys. Soc. paper.

621.317.029.3/.6 **3685**

Alternating Current Measurements at Audio and Radio Frequencies. [Book Review]—D. Owen. Methuen, London, 2nd edn, 120 pp., 5s. (*J. sci. Instrum.*, Sept. 1946, Vol. 23, No. 9, p. 218.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.714.7 : 621.317.39 **3686**

Electronic Gaging.—P. H. Hunter. (*Electronic Industr.*, Sept. 1946, Vol. 5, No. 9, pp. 68–71.) Describes two micrometers, one using a valve circuit for indicating the moment of contact (between the micrometer screw and the material measured) and the other using a photoelectric technique for continuous gauging of soft materials without physical contact.

535.61–15 : 536.51.072.2 **3687**

Thermal Detectors.—(*Electronic Industr.*, Sept. 1946, Vol. 5, No. 9, pp. 87..118.) Survey of the various principles used, especially superconductivity, and description of two bolometers, one of which can detect a temperature change as small as 10^{-6} °C, and has a time constant of the order of 1 ms. Sensitive apparatus of this type can be used for measurements of stellar radiation, atmospheric humidity, small r.f. currents, for physiological studies and in navigation.

535.61–15 : 621.383 **3688**

Investigations of Near Infra-Red Radiations by means of Image Converters.—A. Vasko. (*Nature, Lond.*, 17th Aug. 1946, Vol. 158, No. 4007, p. 235.) " The spectrum under test is projected on to a photo-electric cathode of the type (Ag)–Cs_2O, Cs, Ag–Cs. . . [The photo-electrons] are focused by an electronic lens and form a picture on the fluorescent screen . . ."

539.16.08 **3689**

Various Papers on Geiger-Müller and Other Particle Counters.—(*See* 3759/3762.)

621.316.7 **3690**

Industry studies New Circuit Technics.—R.R.B. (*Electronic Industr.*, Sept. 1946, Vol. 5, No. 9, pp. 66–67..130.) A general article comparing electronic control with pneumatic, hydraulic and mechanical systems.

621.317.39 : 620.172.222 **3691**

Electrical Resistance Wire Strain Gauges.—(*Engineering, Lond.*, 9th Aug. 1946, Vol. 162, No. 4204, pp. 121–123.)

621.317.49 **3692**

Magnetism and the Testing of Materials.—R. V. Baud. (*Engineering, Lond.*, 12th July 1946, Vol. 162, No. 4200, pp. 41–42.) The theory is given of (*a*) the X-ray absorption method, (*b*) the magnetic method, used in flaw detection, and the merits of each discussed. An abridged translation from *Schweiz. tech. Z.*, 11th Oct. 1945, p. 515.

621.365.5 : 669.14 : 621.785.6 **3693**

The Surface Treatment of Metals and in Particular the Surface Hardening of Steel by High-Frequency Currents.—R. Casti. (*Brown Boveri Rev.*, Sept. 1944, Vol. 31, No. 9, pp. 306–308.) A discussion on the main factors which determine the thickness of the hardened zone, with brief notes on the design of a suitable heating coil. The results of tests on surface hardening of a chromium-steel disk, and of a carbon-steel shaft are given. These prove that variation of heating time provides a means of fixing the thickness of the hardened layer without affecting the degree of hardness.

621.365.92 : 674 **3694**

Joints in a Jiffy [by means of electronic heating of wood]**.**—J. Markus. (*Sci. Amer.*, June 1946, Vol. 174, No. 6, pp. 245–248.)

621.365.92 : 678 **3695**

Capacity-Current Heating in the Rubber Industry.—T. H. Messenger. (*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, pp. 270–272 . . 276.)

621.365.92 : 679.5 **3696**

Hardening of Plastics by High-Frequency Power.—H. Stäger & F. Held. (*Brown Boveri Rev.*, Sept. 1944, Vol. 31, No. 9, pp. 298–305.) The changes in a plastic when subject to hardening by hot plate presses and by high-frequency power are outlined.

A series of tests carried out on pure resins and on laminated wood is described. The 23-Mc/s generator provided 1.5 kW for heating small cylindrical specimens of resin and 3-cm wooden cubes. The temperature of the specimen was measured by thermocouples inserted at the centre and 0.5 cm from the surface. The relations between applied voltage, heating time, and temperature are shown graphically. A comparison was made of the hardening produced by hot-plate and high-frequency power methods, and the results are given.

621.38 : 655.324.5 **3697**

Electronic Register Control for Multicolor Printing.—W. D. Cockrell. (*Trans. Amer. Inst. elect. Engrs*, Aug./Sept. 1946, Vol. 65, Nos. 8/9, pp. 617–622.)

621.38.001.8 **3698**

Tubes on the Job.—(*Electronic Industr.*, Sept. 1946, Vol. 5, No. 9, pp. 98–99.) Describes briefly the use of electronic apparatus in (*a*) mobile radio for trucks, (*b*) rubber weighing, (*c*) a wheel balancer, (*d*) a coin rejector, (*e*) a wind-up reel regulator, and (*f*) stress measurements on steel trusses.

621.38.078 : 6 **3699**

What Industry seeks in Electronic Control.—P. Ewald : L. C. Roess : H. K. Steele. (*Electronic Industr.*, Sept. 1946, Vol. 5, No. 9, pp. 85–86 . . 116.) Chemists need reliable and corrosion-proof electronic measuring instruments.

In the oil industry, mass spectrometers, absorption spectrometers, electronic computers, knock meters, and devices for measuring electrical conditions causing corrosion could usefully be developed.

The food industry needs improved devices for colour determination, rapid heating, and determination of moisture.

621.383.001.8 **3700**

Reading Aid for the Blind.—V. K. Zworykin & L. E. Flory. (*Electronics*, Aug. 1946, Vol. 19, No. 8, pp. 84–87.) A light synchronized with a f.m. audio-oscillator moves over a line. Reflected light actuates an amplifier by means of a photoelectric cell when the scanning spot is over the black portion of a character. A distinctive sound thus corresponds to each letter.

621.384 **3701**

Various Papers on Electron Accelerators.—(*See* 3786/3789.)

621.385 : 6 **3702**

Electronic Inspection.—V. Zeluff. (*Sci. Amer.*, Feb. 1946, Vol. 174, No. 2, pp. 59–61.) Use of cathode-ray tubes and other electronic devices for production testing where speed and accuracy are needed.

621.385.001.8 : 518.5 **3703**

Electronic Computers.—Shannon. (*See* 3655.)

621.385.833+5353.17.6 **3704**

A Magnetic Lens with Minimum Spherical Aberration.—A. G. Vlasoff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 5, pp. 235–239. In Russian.) The spherical aberration of a magnetic lens is considered, and a formula (1) for calculating it is given. Methods are indicated for deriving conditions under which spherical aberration would be a minimum. The case of a "short" magnetic lens is discussed in greater detail, and the shape of the pole shoes satisfying the required conditions is determined.

An abstract in English was noted in 1946 of July.

621.385.833 **3705**

Calculation of the Fields of Simple Electrostatic Lenses.—A. G. Vlasoff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 5, pp. 240–242. In Russian.) Lenses are considered which represent systems of (*a*) a number of plane metallic electrodes perpendicular to the optical axis, and having circular apertures with their centres on the optical axis, and (*b*) a number of cylindrical surfaces with their axes coinciding with the optical axis. A function is found satisfying Laplace's equation within the space bounded by the electrodes, and passing through given values at the electrodes. It is shown that the problem can be reduced to that of Dirichlet for the case of a cylinder, and, starting from Laplace's equation, a solution (10) is found which satisfies all conditions of Dirichlet's problem.

An abstract in English was noted in 1945 of July.

621.385.833 **3706**

The Electrostatic Electron Microscope.—H. Bruck & P. Grivet. (*Onde élect.*, June 1946, Vol. 26, No. 231, pp. 175–227.) From the Electron Optics Laboratory of the Compagnie Générale de Télégraphie Sans Fil. Details of the theory and design, illustrated by examples of photomicrographs. It is claimed that the electrostatic type, though slightly inferior to the magnetic type in resolving power, gives images richer in contrast, and is less exacting in its power-stabilization requirements.

621.385.833 : 537.533 **3707**

Extraction of Electrons by an Electric Field.—Lukirski. (*See* 3581.)

621.389 : 535.61–15 **3708**

Sight at Night.—V. Zeluff. (*Sci. Amer.*, July 1946, Vol. 175, No. 1, pp. 21–23.) Possible uses of infra-red beams for travel at night or in fog.

621.39.083.7 : 539.89 **3709**

Telemetering for Project Crossroads.—J. W. Colton. (*Electronic Industr.*, Sept. 1946, Vol. 5, No. 9, pp. 76–79 . . 135.) Engineering details of the equipment for recording the air and water pressures in the Bikini atomic bomb tests.

622.19 : 621.396 **3710**

The Impedance Method of Radio Prospecting. Practical Applications : Parts 1 & 2.—V. Fritsch. (*Arch. tech. Messen*, July & Aug. 1940, Nos. 109 & 110, pp. T75–76 & T90.) The measurement of resistance and capacitance between electrodes provides geological data which are of particular use in tectonic regions. Fissures, faults, cavities and water pockets can be detected from the capacitance variations observed as the electrodes are moved over the region. In interpreting measurements on glaciers the dependence of resistivity and dielectric constant of ice on temperature, frequency and impurities must be taken into account. The detection of coal, salt and ores is discussed. A table of the resistivities of various geological materials in the dry state is given. Other parts have been referred to in 1942 and 1943 abstracts.

622.19 : 623.26 : 621.396.9 **3711**

Treasure Finding Modernized.—W. E. Osborne. (*Radio News*, Sept. 1946, Vol. 36, No. 3, pp. 30..94.) General article on the adaptation of mine detectors to the location of metals and other materials, with mention of the various types of equipment used.

623.26 : 621.396.9 **3712**

The Problem of Land-Mine Detection. Detection of Metallic Masses of Small Dimensions.—H. Grumel & P. Morel. (*Ann. Radioélect.*, Jan. 1946, Vol. 1, No. 3, pp. 160–167.) A review of the problems of mine detection and of the electrical, military, and practical requirements for a detector. The S.F.R. model 451 is described in detail. It contains an exploring head consisting of two tuned iron-cored coils having mutually perpendicular axes to give zero coupling. One coil is part of the resonant circuit of a push-pull oscillator (at about 280 c/s) and the other is followed by a 2-valve tuned amplifier (gain about 70 db) feeding headphones. Two magnetic zero adjustments are provided to cater for in-phase and quadrature effects. With this detector the German "Schuhmine" could be detected easily at a depth of 10 cm, and an anti-tank mine at 55 cm.

623.454.25 : 621.396.9 **3713**

Radio Proximity Fuze Design.—W. S. Hinman, Jr., & C. Brunetti. (*Bur. Stand. J. Res.*, July 1946, Vol. 37, No. 1, pp. 1–13.) Particularly for bombs, rockets and mortars. The fuses operate on the principle that the Döppler beat between the e.m. radiation from an antenna on the projectile and the reflected radiation from a target is received by the same apparatus, amplified and used to control the detonator.

A description is given of the aerials, oscillating detectors, amplifiers and power supplies used, with a short account of the production, laboratory testing, and field testing processes.

621.317.755 : 6 **3714**

The Cathode-Ray Oscillograph in Industry. [Book Review]—Wilson. (*See* 3797.)

621.385.833 **3715**

Introduction to the Electron Microscope. [Book Review]—F. E. J. Ockenden. Williams & Northgate (Norgate), London, 1946, 24 pp., 27 figs., 2s. 6d. (*Elect. Rev., Lond.*, 13th Sept. 1946, Vol. 139, No. 3590, p. 430.) ". . . [this monograph, the second of a series] can be recommended to those who need a clear explanation . . . of the three principles on which electron microscopy is based."

621.386.1 **3716**

X-Rays in Practice. [Book Review]—W. T. Sproull. McGraw-Hill, London, 615 pp., 30s. (*J. sci. Instrum.*, Sept. 1946, Vol. 23, No. 9, p. 218.)

PROPAGATION OF WAVES

538.566.029.63 : 535.42 **3717**

Diffraction Pattern of a Circular Aperture at Short Distances.—C. L. Andrews. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 684.) Measurements were made for λ 12.8 cm with aperture of 1 to 6λ. Fresnel zone theory could be used as an approximate guide. Checks were made against Kirchhoff's theorem. Summary of Amer. Phys. Soc. paper.

538.566.029.64 : 535.43 : 551.48 **3718**

The Frequency Dependence of Radar Echoes from the Surface of the Sea.—H. Goldstein. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 695.) The scattering cross-section σ per unit area of sea surface has been measured on λ 9.2, 3.2, and 1.25 cm. Although the $1/\lambda^4$ Rayleigh law, which would indicate scattering by spray droplets, is not observed, the changes of σ with polarization and with frequency are difficult to explain on the basis of scattering from large sea surfaces. Summary of Amer. Phys. Soc. paper.

621.396.11 + 538.569.4].029.64 : 551.57 **3719**

Absorption of Microwaves by Water Vapor.—S. H. Autler, G. E. Becker & J. M. B. Kellogg. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 694.) A new method, using a cubical copper cavity of 8$\frac{1}{2}$-ft side, within which thermocouples are placed at random, enables the loss of water vapour at various humidities to be measured. Over the range λ 0.7–1.69 cm there is an absorption peak at λ 1.33 cm where the attenuation is 0.024 db/km for 1 gm/m^3 of water vapour. Summary of Amer. Phys. Soc. paper.

621.396.11 : 551.51.053.5 **3720**

Wave-Treatment of Propagation of Electromagnetic Waves in the Ionosphere.—M. N. Saha & B. K. Banerjea. (*Indian J. Phys.*, Oct. 1945, Vol. 19, No. 5, pp. 159–166.) "Wave-equations for the propagation of e.m. waves through the ionosphere have been obtained by the use of a new mathematical method involving the use of dyadic analysis introduced by Gibbs. Expressions for steady-current conductivity of the ionosphere have been obtained by this method and the results agree with those of Chapman; an extra term for the conductivity, which is more prominent in the F_2-layer, has been obtained.

"It has been shown that the wave is split up into three waves, as in Zeeman effect, one of which is ordinary, the other two extraordinary, in accordance with observations by Toshniwal, and Harang."

621.396.11 : 551.51.053.5 **3721**

Short-Wave [ionospheric] **Forecasting.**—T. W. Bennington. (*Wireless World*, Aug. 1946, Vol. 52, No. 8, pp. 246–250.) As a result of wartime needs, ionospheric stations were set up all over the world. By means of their observations, world contour charts both of existing ionospheric conditions and of predicted conditions for any month of the year were constructed. The charts are customarily drawn in terms of the maximum usable frequency for 2 500 miles (the maximum distance of travel of a radio wave with only one reflection by the ionospheric layers). It was found that the ionization of the layers causing reflection depended on both the geographic and the geomagnetic latitude and longitude of the observing station. To take account of this the world is divided into three zones, bounded by certain geomagnetic meridians, and separate charts are issued for each zone. To be continued.

RECEPTION

534.78 **3722**

Effects of Amplitude Distortion upon the Intelligibility of Speech.—Licklider. (*See* 3524.)

534.78 **3723**

Effects of Frequency Distortion upon the Intelligibility of Speech.—Egan & Wiener. (*See* 3525.)

534.78 **3724**

Correlation of the Audio Characteristics of Communication Systems with Measured Articulation Scores.—Beranek. (*See* 3526.)

621.314.632.029.6 **3725**

Noise in Radar Crystal Detectors.—L. I. Schiff. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 682.) A calculation of noise due to shot effect of electrons crossing the blocking layer. A frequency-independent spectrum is deduced. Summary of Amer. Phys. Soc. paper.

621.395.623.6 **3726**

Development of Midget Earphones for Military Use.—Pearson, Mundel, Carlisle, Knauert & Zarat. (*See* 3534.)

621.395.623.7 **3727**

The Output Stage.—A. W. Stanley. (*Wireless World*, Aug. 1946, Vol. 52, No. 8, pp. 256–259.) Curves are given of the variation with frequency of resistance and reactance of a typical moving-coil loudspeaker. By considering these and the equivalent circuit of the output stage of an audio amplifier, the theoretical effects of correct matching are deduced. Frequency response curves taken under practical conditions are reproduced, showing that a knowledge of the response curve of a loudspeaker is useless unless the impedance of the driving source is known.

621.395.667 **3728**

Fundamental Tone Control Circuits—a Reference Sheet.—(*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, pp. 278–279.) Full circuit details of resistance and capacity networks, for obtaining the four chief types of tone control.

621.395.92 **3729**

Desirable Frequency Characteristics for Hearing Aids.—Davis, Hudgins, Peterson & Ross. (*See* 3538.)

621.396.619 **3730**

Comparison of Frequency Modulation and Amplitude Modulation.—T. J. Weijers. (*Philips tech. Rev.*, March 1946, Vol. 8, No. 3, pp. 89–96.) The relative merits of amplitude and frequency modulation in relation to noise and interference, and the advantages of frequency modulation with wide frequency-sweep and adequate receiver-limiting for high-fidelity broadcasting, are discussed.

621.396.619.018.41 : 621.396.621 **3731**

Linear Frequency Discriminator.—J. R. Tillman. (*Wireless Engr*, Oct. 1946, Vol. 23, No. 277, pp. 281–286.) The disadvantages of discriminators which include inductances (*e.g.* variability with temperature) are described, and the design of a resistance-capacitance discriminator is discussed. This design is based on the output *versus* frequency characteristic of the Wien bridge near the balance frequency, and consists of two twin-T networks having suitably staggered balance frequencies. The linearity is good over the whole required range of frequency. This is true even for wide-band circuits if additional networks are used. The performance can probably be made substantially independent of temperature.

621.396.62.029.62 **3732**

Mobile Receiving Equipment for Two, Six and Ten Meters.—E. P. Tilton. (*QST*, Sept. 1946, Vol. 30, No. 9, pp. 28–35.) The system described uses three units: (*a*) an i.f. amplifier using a frequency of 11 Mc/s, superregenerative detector and audio stage; (*b*) a converter to cover two frequency ranges, 27–30 Mc/s and 50–54 Mc/s; (*c*) a converter for the 144–150 Mc/s band.

621.396.621 + 621.396.61] : 621.396.932 **3733**

Transmitting Equipment for the Merchant Navy.—Grumel. (*See* 3805.)

621.396.621 **3734**

An Amateur-Built Eight-Valve Communications Superhet.—E. W. Nield. (*R.S.G.B. Bull.*, Oct. 1946, Vol. 22, No. 4, pp. 50–54, 57.) A circuit design incorporating what are considered to be the most desirable features of various existing designs. The performance claimed is well up to commercial standards; 1 W is delivered by the loudspeaker for an input voltage to the receiver of less than 1 μV (30 per cent sine wave modulation). The a.v.c. is substantially flat above an input of about 5 μV.

621.396.621 **3735**

Modern Home Receiver Design.—Z. Benin. (*Electronics*, Aug. 1946, Vol. 19, No. 8, pp. 94–98.) The design of a commercial receiver suitable for f.m. operation in the 88–108 Mc/s portion of the spectrum as well as in the usual broadcast bands is considered in some detail. Necessary compromises in stage design to ensure satisfactory performance in the two roles are discussed. Particular attention is paid to the aerial circuits, i.f. transformer design and frequency stability of the conversion oscillator.

621.396.621.5 **3736**

Frequency Deviation Reception.—D. A. Griffin. (*Proc. Radio Cl. Amer.*, April 1946, Vol. 23, No. 4, pp. 3–7.) A description of a method of achieving increased selectivity and signal/noise ratio in the reception of keyed c.w. telegraphy signals. It is based upon the frequency modulation of the signals in the receiver itself in such a way that the desired signal is brought periodically within a narrow pass band while nearby unwanted signals remain just outside this pass band. An additional possibility is that by the suitable location of the mean frequency of the wanted signal relative to a narrow pass band, its frequency modulation can be converted into an amplitude modulation with a major component of twice the modulation frequency, whereas that of nearby unwanted signals remains at the fundamental. Thus audio-frequency discrimination can be used to gain additional selectivity.

Means of realizing these possibilities by the use of a double frequency-change process, with frequency modulation of the first conversion oscillator, are described.

621.396.621.53.018.41.012.7 **3737**

Mixer Frequency Charts.—R. S. Badessa. (*Electronics*, Aug. 1946, Vol. 19, No. 8, p. 138.) The charts deal with either sum or difference frequency mixers, and show the combinations of high order frequency components which are capable of beating together to give a resultant frequency coinciding with the desired output value.

621.396.645 : 629.135 **3738**

Isolation Amplifiers for Aircraft.—G. F. Rogers. (*Electronics*, Aug. 1946, Vol. 19, No. 8, pp. 122–123.) A device enabling members of an aircraft crew to listen as required to the various aircraft receivers without mutual interference. Each member is provided with his own single valve amplifier, to the control grid of which the receiver outputs are connected through decoupling resistors and selector switches. The grid circuit constant and gain of the amplifier are chosen so that satisfactory operation is achieved with up to five input channels.

621.396.82 **3739**

BCI [broadcast interference]**.**—G.G. (*QST*, Sept. 1946, Vol. 30, No. 9, pp. 54–55.) Interference caused by amateur transmitters in the vicinity of broadcast receivers has been found due in certain cases to r.f. voltages being rectified at the grid of the first audio amplifier in receivers having poor shielding such as the midget a.c.–d.c. types. The trouble may be reduced or entirely overcome by inserting a suitable resistance in the grid circuit so that the grid capacitance and this resistance form a low-pass filter to the r.f. voltages. Alternative methods are mentioned using suitable by-pass capacitors in the grid circuit.

621.396.822.029.6 **3740**

Signal-Noise Ratio at V.H.F.—M. J. O. Strutt & A. van der Ziel. (*Wireless Engr*, Sept. 1946, Vol. 23, No. 276, pp. 241–249.) Analyses are given of the signal/noise ratios of the grounded-cathode and grounded-grid triode amplifiers, assuming the use of equivalent noise current generators. The partial coherence of the induced grid noise and the anode or cathode noise determines the optimum values of the grid circuit detuning and aerial coupling; experimental confirmation is given (*cf.* Strutt & van der Ziel, 749 of 1945). Similar results are obtained for the velocity-modulation amplifier (Müller, 48 of 1943). The paper concludes with a discussion of valve and circuit design for maximum sensitivity. The authors' noise ratio w is compared with other definitions of noise factor.

621.396.823 : 621.43.04 **3741**

Motor-Car Ignition Interference.—C. C. Eaglesfield. (*Wireless Engr*, Oct. 1946, Vol. 23, No. 277, pp. 265–272.) A simple theory is given in which the spark gap is replaced by a switch, and the radiating part of the ignition system by a small loop close to the plane earth. The initial current in the loop and hence the radiated field and the duration of the pulse are obtained. Comparison of the field strength calculated by this means with values measured by other observers shows agreement. The waveforms of the radiated field from a spark plug and from cars were investigated on a television receiver connected to a second c.r.t. from which photographs of the pulse trains were taken. From these photographs the number of pulses per train and its average duration for several makes of car were tabulated.

STATIONS AND COMMUNICATION SYSTEMS

621.391.1 **3742**

Multichannel Communication Systems.—F. F. Roberts & J. C. Simmonds. (*Alta Frequenza*, Sept./Dec. 1945, Vol. 14, Nos. 3/4, pp. 236–238.) Long summary in Italian of 183 of January and 416 of February.

621.395.332.029.64 (44) **3743**

First Microwave Telephone System operating on Busy Paris Route.—(*Telegr. Teleph. Age*, Sept. 1946, Vol. 64, No. 9, pp. 5, 6.) An announcement of the introduction into regular service by the French Ministry of Posts, Telegraphs and Telephones of a 12-channel, 3 000 Mc/s, frequency-modulated radio link between Paris and Montmorency.

621.395.44 **3744**

The Unit Bay 1B Coaxial Cable Transmission System : Part 4.—R. A. Brockbank & C. F. Floyd. (*P.O. elect. Engrs' J.*, July 1946, Vol. 39, Part 2, pp. 64–65.) Continuation of 2000 of July, dealing with the installation and operation.

621.396 : 061.5 **3745**

High-Frequency and Communications Engineering.—K. Sachs & W. G. Noack. (*Brown Boveri Rev.*, Jan./April 1943, Vol. 30, Nos. 1/4, pp. 59–64.) Review of the Brown Boveri Company's work in 1942 including notes on (*a*) development of microwave oscillators, and applications of microwaves to distance-measurement and communication problems; (*b*) secrecy equipment on telephone and telegraphic systems; (*c*) medium and short-wave transmitters using remote control; (*d*) broadcast studio equipment; (*e*) supervisory remote-control systems applied to power-stations, railways, and industrial problems.

621.396 : 061.5 **3746**

High-Frequency and Communications Engineering.—K. Sachs & W. G. Noack. (*Brown Boveri Rev.*, Jan./Feb. 1944, Vol. 31, Nos. 1/2, pp. 86–93.) A review of research and development work undertaken in 1943 by the Brown Boveri Company, including notes on filters using artificially cultivated crystals, f.m. and unidirectional aerials applied to the design of sets for multichannel operation; magnetron developments, and an impedance-measuring device for u.h.f. work; medium-wave broadcast transmitters, and equipment used in police wireless communication; a telemetering system for supervisory control, and a low-voltage network telecontrol system.

621.396.029.56/.62 **3747**

Amateur Bands.—(*Wireless World*, Aug. 1946, Vol. 52, No. 8, p. 271.) The frequency bands now available to British amateur transmitters are 1.8–2.0, 7.15–7.30, 14.1–14.3, 28.0–30.0, and 58.5–60.0 Mc/s. These may be used for c.w., m.c.w., and R/T. The power limitations are given.

621.396.13 **3748**

A Preview of the Western Union System of Radio Beam Telegraphy : Part 2.—J. Z. Millar. (*J. Franklin Inst.*, July 1946, Vol. 242, No. 1, pp. 23–40.)

A description of the centimetre-wavelength beam system developed by R.C.A. for inter-city communications. Thirty-two voice-frequency bands in the range 500 c/s–150 kc/s modulate the frequency of a 1-Mc/s sub-carrier with a peak deviation of 400 kc/s. This signal in turn modulates the frequency of the r.f. transmitter, which has a peak deviation of 2 Mc/s. The transmitter has a power output of 50 mW. With a parabolic reflector to the antenna, the range is 55 miles. The effects of atmospheric conditions on the choice of operating frequency are considered, and vertical diversity reception is proposed to overcome interference fading. The repeater stations, which are mounted on steel towers, demodulate the signal to the 1-Mc/s sub-carrier, which then modulates a transmitter on a nearby frequency. The proposed relay networks are shown with examples of the terrain profile. For part 1 see 3048 of October.

621.396.13 **3749**

Reuters' Wireless Services.—W. West. (*P.O. elect. Engrs' J.*, July 1946, Vol. 39, Part 2, pp. 48–52.) An account of the development of Reuters' service of news distribution from British Post Office transmitters, including the long-wave "European", and the short-wave "World" services, together with a description of the German Hellschreiber telegraph system.

621.396.24.029.64 **3750**

Radiotelephone Links on Ultra-Short Waves.—F. Vecchiacchi. (*Alta Frequenza*, March 1946, Vol. 15, No. 1, pp. 3–14. With English, French and German summaries.) U.h.f. links can be used advantageously in multichannel long-distance telephony in Italy where the mountains provide natural intermediate relay points. The choice of wavelength, station spacing, modulation system, repeating system, and multiplexing system is discussed. Profile curves illustrate three possibilities for the Milan-Turin link. The Milan-Rome link which is nearly 500 km direct requires only two intermediate stations.

621.396.619.018.41 **3751**

Frequency Modulation: B.B.C. Field Trials.—H. L. Kirke. (*B.B.C. Quart.*, July 1946, Vol. 1, No. 2, pp. 62–80.) A detailed description of results obtained from the following tests: "1. Propagation tests on 45 and 90 Mc/s (field strength *versus* distance, for both horizontal and vertical polarization). 2. Fading measurements at various distances. 3. Comparative tests on f.m. and a.m. 4. Signal/noise ratio tests. 5. Practical listening tests with different types of receivers at various distances and in the homes of ordinary listeners." It is thought that the optimum conditions for a British u.s.w. f.m. broadcasting service are: maximum deviation 75 kc/s; pre-emphasis 50 μs; carrier-channel spacing 200 kc/s, but 400 kc/s between transmitters serving the same area. See also *Wireless World*, Oct. 1946, Vol. 52, No. 10, pp. 316–320.

621.396.619.16 **3752**

Pulse Modulation.—A. S. Gladwin. (*Wireless Engr*, Oct. 1946, Vol. 23, No. 277, pp. 288–289.) A further contribution to the discussion given in various letters to *Wireless Engineer* since the article by Roberts & Simmonds (see 3054 of October and back references). A single general formula is here derived, in terms of which all types of modulated pulse trains with constant amplitude pulses can be represented.

621.396.82 **3753**

Adjacent Channel Interference.—A. G. Dunn. (*R.S.G.B. Bull.*, Oct. 1946, Vol. 22, No. 4, pp. 55–57.) To relieve congestion on amateur frequencies, it is essential (*a*) to improve apparatus, *e.g.* by using beam aerials and the least possible power, (*b*) to improve operating procedure: operators should be able to read morse well, choose frequency correctly, and use variable frequency oscillators where feasible; unnecessary "netting" should be avoided, (*c*) to share time and frequency more drastically.

621.396.9.015.33 **3754**

Pulse Technique and Its Applications [to radar].—A. de Gouvenain. (*Cah. toute la Radio*, Sept. 1945, No. 3, pp. 2–4.) An elementary description.

SUBSIDIARY APPARATUS

534.41 + 534.781 **3755**

The Sound Spectrograph.—Koenig, Dunn & Lacy. (*See* 3517.)

534.41 + 534.781] : 535.37 **3756**

Visible Speech Translators with External Phosphors.—Dudley & Gruenz. (*See* 3519.)

534.41 + 534.781] : 621.385.832 **3757**

Visible Speech Cathode-Ray Translator.—Riesz & Schott. (*See* 3520.)

537.525.3 : 621.316.722.078.3 **3758**

Characteristics of the Pre-Corona Discharge and Its Use as a Reference Potential in Voltage Stabilizers.—S. C. Brown. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, pp. 696–697.) Summary of Amer. Phys. Soc. paper.

539.16.08 **3759**

Radioactivity Meter for Nuclear Research.—A. G. Bousquet. (*Electronic Industr.*, Sept. 1946, Vol. 5, No. 9, pp. 88–89.) A commercial Geiger-Müller counter and associated amplifier for rate counting with valve quenching and meter indication.

539.16.08 **3760**

Small Mica Window Geiger-Müller Counter for Measurements of Radioactive Isotopes in Vivo.—E. Strajman. (*Rev. sci. Instrum.*, June 1946, Vol. 17, No. 6, pp. 232–234.)

539.16.08 **3761**

System for High Speed Counting of Nuclear Particles.—H. L. Schultz. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 689.) Summary of Amer. Phys. Soc. paper.

539.16.08 : 547.2 **3762**

Organic Vapors for Self-Quenched G.M. Counters.—E. der Mateosian & H. Friedman. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 689.) Summary of Amer. Phys. Soc. paper.

621–526 **3763**

Parallel Circuits in Servomechanisms—H. T. Marcy. (*Trans. Amer. Inst. elect. Engrs*, Aug./Sept. 1946, Vol. 65, Nos. 8/9, pp. 521–529.). A general mathematical technique for the analysis of servomechanisms in which the inclusion of a component in the feedback circuit modifies the controlled quantity before comparison with the desired quantity. A bibliography of 8 items is given.

621-526 **3764**

The Frequency Response of Automatic Control Systems.—H. Harris, Jr. (*Trans. Amer. Inst. elect. Engrs*, Aug./Sept. 1946, Vol. 65, Nos. 8/9, pp. 539–546.) The accepted method of transient-response analysis of servomechanisms becomes unwieldy with complex systems. A frequency-response method based on Fourier analysis is advocated which gives equivalent results more simply. A numerical example is given of a torque amplifier with motor generator control.

621.314.12 : 621.394/.396].66 **3765**

The Amplidyne Electrical Control System.—British Thomson-Houston Company. (*Engineering, Lond.*, 2nd Aug. 1946, Vol. 162, No. 4203, pp. 103–105.) The machine is essentially a d.c. generator with an unusually low field-power, which can be used for automatic control of voltage, current, or power factor with good transient response. A description of several applications is given.

621.314.2 : 621.396.619 **3766**

Modulation Transformers for Broadcasting Transmitters.—M. G. Favre. (*Brown Boveri Rev.*, Sept. 1944, Vol. 31, No. 9, pp. 323–326.) For 100% modulation, the highest quality is obtained with anode modulation of the final radio-frequency amplifier. The requirements for a class-B modulator and the design of the modulation transformer are given. The response curve of an 8.5-kW modulator indicates a loss of 0.5 db at 30 and 10 000 c/s when the transformer has an efficiency of 95%.

621.314.53 **3767**

Rotary Converter for Portable Power Supplies.—(*Electronics*, Aug. 1946, Vol. 19, No. 8, p. 142.) Coils rotating in a magnetic field carry with them an evacuated glass sphere containing mercury, which makes contact successively with tungsten electrodes. "The complete cased unit resembles a conventional vibrator in appearance."

621.314.6 + 621.319.4 + 621.383] : 669.018 **3768**

Light Alloys in Metal Rectifiers, Photocells and Condensers.—A series of anonymous articles under this or similar title has appeared in various issues of *Light Metals* since April 1944.

(i) April 1944, Vol. 7, No. 75, pp. 162–172. ". . . the theory and practice of the use of aluminium and magnesium [in metal rectifiers] are examined."

(ii) June 1944, Vol. 7, No. 77, pp. 276–298. "Particular attention is [here] paid to the selenium rectifier, and the use made of light metals in its construction."

(iii) Sept. 1944, Vol. 7, No. 80, pp. 437–458. "Concluding . . . a study of the selenium rectifier, and introducing a comprehensive discussion on photocells and the role of light metals in their construction."

(iv) Oct. 1944, Vol. 7, No. 81, pp. 505–512. "Continuing . . .a discussion on photocells. The copper-oxide and caesium types are here dealt with."

(v) Nov. 1944, Vol. 7, No. 82, pp. 525–529. "Apparatus, auxiliary materials and technique employed in preparing and handling alkali metals for photocells are described. Physical and chemical properties of these metals and methods for their extraction are then briefly discussed."

To be continued.

621.317.755 **3769**

Modification to Cossor Oscilloscope Model 339 to enable Modulation Measurements to be made at Carrier Frequencies above 20 Mc/s.—A. J. Muir & J. W. Whitehead. (*J. sci. Instrum.*, Aug. 1946, Vol. 23, No. 8, p. 189.)

621.317.755 **3770**

Fast Sweep Synchroscope.—D. F. Winter. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 695.) The basic problems involved in building a sealed tube cathode-ray oscillograph for measuring time intervals of 10^{-9} sec to within 10% are listed. Summary of Amer. Phys. Soc. paper.

621.317.755 **3771**

Elements of a New Oscilloscope Design.—Simmons. (*See* 3677.)

621.317.755.027.3 **3772**

The Precision-Type Quadruple-Beam High-Voltage Oscillograph.—G. Induni. (*Brown Boveri Rev.*, Sept./Oct. 1943, Vol. 30, Nos. 9/10, pp. 222–223.) One cathode is used and there are four independent deflexion assemblies for voltages up to 3 kV, and two deflexion assemblies for voltages up to 50 kV. The high voltage is supplied to the cathode through a screened lead from an oil-immersed 50-kV d.c. rectifier plant. The cast-iron body of the oscillograph is highly vacuum-tight and provides excellent screening, rubber packing helps to maintain the vacuum, and one molecular pump suffices. The beams are independently adjusted for intensity and shift, and a common focusing coil is used.

621.318.24 **3773**

Condenser-Discharge Magnetiser for Permanent Magnets.—F. Brailsford. (*Engineering, Lond.*, 16th Aug. 1946, Vol. 162, No. 4205, pp. 145–146.) Permanent magnets may be magnetized conveniently by passing "a high unidirectional current for a short time through a single conductor threading the magnet". This has been done by discharging a capacitor through the primary winding of a transformer with the secondary connected to the single magnetizing conductor. The circuit must be critically damped to obtain maximum peak current without oscillation. See also 2719 of September.

621.318.42 + 621.396.662.21 **3774**

Properties and Application of Standard-Q Coils at High Frequency.—G. Opitz. (*Arch. tech. Messen*, Sept. 1940, No. 111, pp. T106–107.) The self-capacitance C_s of a coil of standard Q $(=\omega L/r)$ can introduce errors according to the method of measurement. The construction of a series of iron-cored standards from 1 μH to 1 H ($Q = 50$–250) is described, and the influence of the iron on the loss and inductance of the coil (as a function of magnetization) is discussed. A 20% change of Q is possible for a ± 10°C temperature change or a variation of 0–80% of relative humidity.

621.318.5 **3775**

Electric Relays : a General Survey.—J. Sorge. (*Arch. tech. Messen*, April 1940, No. 106, pp. T40–41.)

621.318.572 **3776**

Electronic True Decade Counters.—H. G. Shea. (*Electronic Industr.*, Sept. 1946, Vol. 5, No. 9, pp. 82–84 . . 136.) Four double triode multivibrators have neon lamps in each anode circuit. By means of feedback to the third and fifth triode sections it is possible to count up to ten input pulses directly thus avoiding conversion to and from the binary scale. Another counter, described in 2496 and 2497 of September, uses ten directly-coupled twin pentodes arranged in a ring and variations of this circuit may be triggered by a.c.

621.319.3.027.3 **3777**

A Compact High Voltage Electrostatic Generator using Sulphur Hexafluoride Insulation.—W. W. Buechner, R. J. Van de Graaff, A. Sperduto, E. A. Burrill, L. R. McIntosh & R. C. Urquhart. **Preparation and Physical Properties of Sulfur Hexafluoride** [for use in generator].—W. C. Schumb. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 692.) The generator can produce over 5 MV, and has been used for investigating the dielectric properties of various gases including air. Summary of Amer. Phys. Soc. papers.

621.319.4 : 620.193.91 **3778**

Capacitor Life Testing.—J. R. Weeks. (*Bell Lab. Rec.*, Aug. 1946, Vol. 24, No. 8, pp. 296–299.) Relationships discovered in the last fifteen years between voltage, temperature, and life form the basis of accelerated tests in which the probable life can be determined in two weeks. The testing apparatus is described.

621.319.4.029.5 : 621.315.612 **3779**

High Frequency Ceramic Capacitors.—B. M. Vul & G. I. Skanavi. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 4, pp. 194–199. In Russian.) For practical purposes the following two types are required : (*a*) compensating, and (*b*) of high stability. The temperature coefficient of permittivity should be negative in the first, and as near as possible to zero in the second. As a result of the present investigation, materials were developed with positive and negative temperature coefficients by combining TiO_2 with MgO ("timag") and $MgCa(CO_3)_2$ ("tidol") respectively. A predetermined value of the coefficient can be obtained by using these materials in various proportions. Experimental curves are plotted showing permittivity ϵ, and its temperature coefficient, as measured in completed capacitors (Fig. 1), the effect of temperature on capacitance (Fig. 2), and the effect of frequency (Figs. 3 and 4) and temperature (Fig. 5) on the loss angle. Formulae are also quoted for calculating the heating of flat and cylindrical capacitors.

A summary in English was noted in 2761 of 1945.

621.383.2 + 535.215.1 **3780**

Complex Photocathodes.—N. S. Khlebnikoff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 5, pp. 286–289. In Russian.) According to de Boer the external photoeffect of complex cathodes is determined by two elementary processes, the photo-ionization of adsorbed atoms, and the movement of the replenishing electrons through the intermediate layer. Investigations of the Sb-Cs type of cathode and later of the Cs-O-Ag type have led the author, however, to the conclusion that complex photocathodes should be regarded as semiconductors with a relatively low value of the work function, operating by the photo-emission of electrons from the depth of the intermediate layer. The advantages of the new theory are discussed, and further possible developments indicated.

An abstract in English was noted in 1819 of July.

621.383.2 **3781**

Certain Physical Properties of Caesium Oxide Photocathodes.—P. M. Morozoff & M. M. Butsloff. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 5, pp. 291–303. In Russian.) A preliminary report on a detailed experimental investigation carried out to determine the spectral distribution of sensitivity, the energy distribution of photo-electrons, and the work function of caesium oxide photocathodes. Curves are plotted in Figs. 2 and 3 showing the spectral sensitivity when the photocathode is illuminated from the rear and the front respectively. The spectral distribution of sensitivity is closely connected with the thickness of the silver layer, and therefore with the thickness of the photocathode. Photocathodes of a given thickness, and therefore of a predetermined spectral sensitivity, can be obtained by varying the depth of the oxidation of the silver layer, and Fig. 4 gives sensitivity curves for photocathodes of different thickness. The difficulties of ensuring the required depth of oxidation are pointed out, and the structure of the photocathodes is discussed in detail. The electrical and optical properties of the silver layer are greatly affected by the temperature of the glass envelope during the deposition of the silver. The volt-ampere characteristics of the photocathodes illuminated from the front (thick lines) and from the rear (dotted lines) are shown in Fig. 9. It appears from these curves that the energy distribution of photo-electrons in this type of cathode is similar to that in the case of pure metals. An irregularity in the energy distribution is apparent, however, on wavelengths of $750\ m\mu$ and more. The reasons for this irregularity are discussed.

Measurements of the work function are described. The value was found to be of the order of 0.78–0.90 V, but may vary with time by as much as ± 1 V over a period of 10–500 hours.

An abstract in English as noted in 2033 of July.

621.383.2 **3782**

The Energy Distribution of Electrons and the Relationship between Photocurrent and the Angle of Incidence of Light in the case of Caesium Oxide Photocathodes.—A. M. Pyatnitski. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 5, pp. 304–308. In Russian.) Results of an experimental investigation are shown in the following curves : Fig. 1 (left)—the photocurrent against the angle of incidence of light; Fig. 1 (right)—reflection, transmission and absorption of light against the angle of incidence ; Fig. 2 (upper curves)—the photocurrent for an angle of incidence of 70° against the wavelength of light ; Fig. 2 (lower curves)—reflection transmission and spectral characteristics against the wavelength ; Fig. 3 (left)—reflection, transmission and absorption, and Fig. 3 (right)—the photocurrent for different structures of the cathode and different angles of incidence ; Fig. 4—volt-ampere characteristics for infra-red light falling at different angles from the front and the rear of the cathode.

Conclusions : (*a*) The photocurrent depends on the angle of incidence of light. The relationship is determined by the structure of the cathode and the wavelength of the light. (*b*) The spectral characteristic also depends on the angle of incidence. (*c*) The maximum of energy distribution, independently of the wavelength, is shifted towards a greater energy value when the cathode is illuminated from the rear.

An abstract in English was noted in 2032 of July.

621.383.2 **3783**

New Photocells with Antimony-Caesium Cathodes.—N. S. Khlebnikoff & A. E. Melamid. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1944, Vol. 8, No. 5, pp. 309–312. In Russian.) Two types of photocell were developed, one for use with ultra-violet radiation, and the other possessing constant sensitivity and capable of operating under both weak and intense illumination. For the first type it is difficult to manufacture an envelope transparent to ultra-violet rays, and methods adopted to overcome this are described. The spectral characteristics of the photocells so produced are shown in Fig. 3. The cells are almost free from fatigue, and possess a very high resistance (of the order of $10^{13}\ \Omega$) between the anode and the cathode.

The production of the second type is based on the fact that the spectral sensitivity of the Sb–Cs cathodes decreases as a result of fatigue down to 50% of the original value, and is not restored after rest. A photocell can therefore be artificially fatigued by exposing it to the illumination of the sky. Photocells with a constant sensitivity (with no greater deviation than ± 10%) and capable of operating under such an intense illumination as 10^4 lux were produced in this way.

An abstract in English was noted in 2031 of July.

621.383.4 + 535.215.1 : 546.28 **3784**

A New Bridge Photo-Cell employing a Photo-Conductive Effect in Silicon. Some Properties of High Purity Silicon.—G. K. Teal, J. R. Fisher & A. W. Treptow. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 686.) An apparatus is described for making bridge-type photocells by reaction of silicon tetrachloride and hydrogen gases at ceramic or quartz surfaces at high temperatures. The variation of the conductivity of pyrolitic silicon films on porcelain with temperature is described and explained. Summary of Amer. Phys. Soc. paper.

621.383.5 **3785**

Blocking-Layer Photocells.—W. C. van Geel. (*Philips tech. Rev.*, March 1946, Vol. 8, No. 3, pp. 65–71.) An account of the structure and functioning of photocells formed from a layer of a semiconductor such as cuprous oxide or selenium separated from a metal electrode by a very thin insulating layer, the blocking layer. The internal and external photo-effects are explained as the action of light quanta in enabling the electrons to pass from one energy band to another. Examples of the characteristics of typical cells are given.

621.384 **3786**

The Synchro-Betatron, Electron Accelerator Guide Fields.—H. F. Kaiser & E. C. Greanias. (*Phys. Rev.*, 1st/15th May 1946, Vol. 69, Nos. 9/10, pp. 536–537.) Discussion of the possibility of modifying the Kerst betratron for operation as a synchrotron, by the synchronized application of an intense guide field which increases in strength with the energy of the particle. A few calculations show the practicability of the scheme, and possible conductor guide systems are considered.

621.384 : 537.291 **3787**

Electron Orbits in the Synchrotron.—D. S. Saxon & J. Schwinger. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 702.) Equations for the orbital motion are derived on the assumption that the localized accelerating field can be replaced by an equivalent rotating electric field. Summary of Amer. Phys. Soc. paper.

621.384 : 621.385.16 **3788**

Preliminary Studies on the Design of a Microwave Linear Accelerator.—J. Halpern, E. Everhart, R. A. Rapuano & J. C. Slater. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 688.) Pulsed magnetrons operating at about 3 000 Mc/s and feeding into high-Q cavities have been used to obtain electron accelerating voltages of the order of 2 MV. Summary of Amer. Phys. Soc. paper.

621.384 : 621.392 **3789**

Wave Guide Acceleration of Particles.—E. L. Hudspeth. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 671.) The disadvantages of a linear accelerator may be overcome by using the transverse field inside a waveguide to accelerate the particles. The guide is bent into a spiral and holes in the walls allow the particles to move along a diameter. Phasing is obtained by adjusting the position of the holes and the spacing of the turns. The guide is short-circuited and operated as a cavity resonator.

621.385.18.029.64 **3790**

Various Papers on TR Switches.—(*See* 3814/3819.)

621.385.832.088 **3791**

C.R. Tube Quality Measuring Apparatus.—Spooner. (*See* 3683.)

621.394.624 **3792**

An Electronic Code Translator.—H. W. Babcock. (*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, pp. 282–283.) Slightly abbreviated reprint of 2730 of September.

621.395.636 **3793**

Dialling Selection Signals at Voice Frequency.—F. Lucantonio. (*Alta Frequenza*, Sept./Dec. 1945, Vol. 14, Nos. 3/4, pp. 195–217. With English, French and German summaries.) General discussion of systems of dialling signals with particular reference to Italian long-distance underground cables. Schematic and detailed circuits of the relay chains are given.

621.396.611.21.032.2 : 546.59 **3794**

Gold Film Electrodes for High Frequency Quartz Plates.—R. A. Spears. (*J. Brit. Instn Radio Engrs*, March/May 1946, Vol. 6, No. 2, pp. 50–59. Discussion, pp. 59–62.) A theoretical and practical discussion of the design of gold film electrodes and their effect on the natural frequency. The behaviour of electrodes is analysed to explain the advantages of adherent films. Factors in the design of film electrodes are the surface displacement of the crystal and the optimum area and location of the electrodes. A short account of a practical method of gold sputtering includes details of the preparation of surface and methods of varying quality, colour, durability, adherence, thickness, and weight of the film. An analysis is given of the effect of the gold deposit on frequency and activity and usual methods of mounting the crystals are described.

621.396.662 **3795**

A Device for [periodic] **Variation of Reactance.**—J. Bernhardt. (*Cah. toute la Radio*, Sept. 1945, No. 3, pp. 21–23.) A flexible vibrating blade has one end fixed, a soft iron armature at the centre and, at the free end, the element for varying reactance, which can be either (*a*) a closed wire loop in the field of a coil, (*b*) a capacitor plate, or (*c*) a piece of soft iron in the air gap of a magnet. The most convenient frequency of oscillation is 50 to 100 c/s. Various possible applications are mentioned.

621.396.682 : 621.316.722 **3796**

Multi-Voltage Regulated Power Supplies.—J. R. Mentzer. (*Electronics*, Sept. 1946, Vol. 19, No. 9, pp. 132–133.) A description of circuits for obtaining outputs at two regulated voltages by the use of standard gas-filled tubes. Any voltage that is a multiple of 15 V, up to the maximum voltage of the unregulated source, can be obtained by suitable additive or subtractive combinations of the tubes. A procedure is given for computing circuit values in relation to voltage and current requirements.

621.317.755 : 6 **3797**

The Cathode-Ray Oscillograph in Industry. [Book Review]—W. Wilson. Chapman & Hall, London, 2nd edn 1946, 18s. (*Engineering, Lond.*, 9th Aug. 1946, Vol. 162, No. 4204, p. 124; *J. sci. Instrum.*, Sept. 1946, Vol. 23, No. 9, p. 218.)

TELEVISION AND PHOTOTELEGRAPHY

621.385.832.088 **3798**

C.R. Tube Quality Measuring Apparatus.—Spooner. (*See* 3683.)

621.397 : 621.396.9 **3799**

Has Radar influenced Television Development?—(*J. Televis. Soc.*, March 1946, Vol. 4, No. 9, pp. 220–222.) A discussion before the Television Society led by F. R. W. Strafford. It was generally agreed that radar owed a great deal to television, but had so far had little influence on television development. It may have more in the future if higher frequency systems are introduced. Improved feeders and smaller and lighter components produced for radar could be adapted for television, but would not result in great reduction of cost to the user.

621.397 : 778.53 **3800**

Film—the Backbone of Television Planning.—R. B. Austrian. (*J. Televis. Soc.*, March 1946, Vol. 4, No. 9, p. 226.) Summary of an address given before the Society of Motion Picture Engineers. The high cost of programmes employing individual artists makes it probable that films will eventually be the major source of television transmissions.

621.397.26 **3801**

Stratosphere Television.—(*J. Televis. Soc.*, March 1946, Vol. 4, No. 9, p. 227.) Usable signals have been transmitted over a distance of 240 airline-miles from an altitude of 25 000 ft using only 250 W of power. These results agree almost exactly with pre-flight calculations. Transmissions to date have been on three frequencies between 100 and 550 Mc/s, with one channel devoted to studies of television "ghosting"; another to f.m. transmission; and the third for communications incident to test operation.

A suitable plane for the purpose is a low-wing all-metal monoplane about the size of the B-29, but weighing only one third as much. "Each plane would weigh 20 tons fully loaded." The original proposals were noted in 3970 of 1945.

621.397.611 **3802**

Portable Video Pickup Equipment.—W. A. Howard. (*Electronics*, Aug. 1946, Vol. 19, No. 8, pp. 124–129.) A portable lightweight television camera and associated control, monitoring and synchronizing equipment, designed to give an output of video and standard synchronizing signals. A detailed description of the camera and each auxiliary unit is given with performance specifications and method of operation.

621.397.645 **3803**

Television V.F. Stage.—W. T. Cocking. (*Wireless World*, Aug. 1946, Vol. 52, No. 8, pp. 265–268.) The advantages of feeding the vision signal on to the cathode of the display tube rather than to the grid are pointed out. A basic circuit, and a suitable synchronization pulse separator stage, are described.

621.397.645 **3804**

Television V.F. Stage.—H. Wood. (*Wireless World*, Oct. 1946, Vol. 52, No. 10, p. 346.) Comments on 3803 above.

TRANSMISSION

621.396.61 + 621.396.621] : 621.396.932 **3805**

Transmitting Equipment for the Merchant Navy.—H. Grumel. (*Ann. Radioélect.*, Jan. 1946, Vol. 1, No. 3, pp. 264–273.) Describes a telephony transmitter for use by unskilled persons giving an aerial power of 30 W on λ 80–220 m. Circuits and details of construction of the transmitter and the associated receiver (mounted in the same unit) are given. Mention is also made of three transmitters for use by skilled persons: (*a*) 300 W (A_1 communication) or 400 W (A_2) on λ 580–820 m, (*b*) 150–200 W (A_1) on λ 18, 24, 36 and 48 m, (*c*) 75 W (A_2) on λ 600 m—distress. Details of these equipments will be published later.

621.396.61.029.54 **3806**

The "Monobloc" 10-kW Broadcast Transmitters Type TH 1308.—C. Beurtheret. (*Rev. tech. Comp. franç. Thomson-Houston*, Oct. 1945, No. 4, pp. 45–52.) Description of a medium-wave transmitter suitable for rapid serial production to replace those of the French broadcasting system destroyed during the war. The anode efficiency of the power stage is 40% for carrier or 80% at peak, and the overall efficiency of the transmitter is 23% on carrier. The harmonic distortion is less than 2% at frequencies of 50–4 000 c/s for 80% modulation and less than 3% at 95% modulation. The noise modulation is 55 db below the level corresponding to 80% modulation. The advantages of the assembly of the transmitter in the form of a single rectangular block are stated.

621.396.611.21.029.62 : 621.396.662.078.3 **3807**

Crystal Control on 144 Mc/s.—W. W. King. (*QST*, Sept. 1946, Vol. 30, No. 9, pp. 46–50.) Three transmitters are described having output powers of 5, 20 and 60 W. The frequency is controlled by a 12 Mc/s A.T.-cut crystal operating on an overtone, frequency multiplication being carried out in stages which drive the output valves. All the transmitters described are plate-modulated.

621.396.615.12.029.5 **3808**

A Simple V.F.O. Crystal Substitute.—D. Mix. (*QST*, Sept. 1946, Vol. 30, No. 9, pp. 13–16.) Practical details of a variable frequency oscillator covering a frequency range from 3 500–4 000 kc/s. In order to obtain high frequency-stability an electron coupled oscillator having a large capacitance in its frequency-determining circuit is followed by two untuned amplifier stages. The oscillator valve is 6SK7 as this is well screened. The amplifier uses two 6F6's, which give little trouble from parasitic oscillations. The high-voltage supply to the oscillator and the first amplifier is stabilized from a regulator tube. The oscillator screen may be keyed without causing serious defects.

621.396.619 : 621.314.2 **3809**

Modulation Transformers for Broadcasting Transmitters.—Favre. (*See* 3766.)

VALVES AND THERMIONICS

621.385.1.032.216 **3810**

The Measurement of Differences of Contact Potential and of Saturation Current in Vacuum Tubes using Oxide Cathodes.—R. Champeix. (*Ann. Radioélect.*, Jan. 1946, Vol. 1, No. 3, pp. 208–235.) The characteristic log $I = f(V)$ (the 'residual current') is used, and is obtained when the electrode considered has a retarding potential relative to the cathode. This measurement of contact p.d. requires a knowledge of the saturation current, and a method for measuring it has been studied and evolved for oxide cathodes by using the discharge of a capacitor controlled by thyratrons. The method of interpreting Schottky's law to deduce the true saturation current is indicated. Evidence is given of the new phenomenon of the modification of the slope of the line log $I = f(\mathrm{V})$ when the condition of the receiving electrode is changed. Methods are proposed for stabilizing the contact p.d. during the industrial production of radio valves.

621.385.1.032.216 : 621.386.1 **3811**

A Study of Oxide Cathodes by X-Ray Diffraction Methods : Part 1—Methods, Conversion Studies, and Thermal Expansion Coefficients.—A. Eisenstein. (*J. appl. Phys.*, June 1946, Vol. 17, No. 6, pp. 434–443.) Two methods are described, one for studying the conversion process in forming the cathode, the other for measuring the thermal expansion coefficients of barium, strontium, and thorium oxides. "The conversion of an equal molar barium-strontium carbonate solid solution, $(BaSr)CO_3$, involves (1) crystal growth in the carbonate, (2) decomposition to the mixed oxides, BaO and SrO, (3) formation of the oxide solid solution, (BaSr)O, and (4) crystal growth in the oxide. A similar sequence of events is observed in the conversion of a mixed carbonate, $BaCO_3 + SrCO_3$. Crystal and particle size, growth of carbonates, and crystal growth of oxides are investigated, and possible relationships are discussed."

621.385.16 + 621.396.9 **3812**

Radar and the Magnetron.—J. T. Randall. (*J. R. Soc. Arts*, 12th April 1946, Vol. 94, No. 4715, pp. 303–312. Discussion, pp. 312..323.) A paper read before the Royal Society of Arts giving a brief account of the basic principles and history of radar, and, in greater detail, of the development of the cavity magnetron.

The development of high powers at centimetre wavelengths began with the klystron (Varian & Varian, 1939) and was followed by the cavity magnetron (Randall & Boot, 1939–40) to which the improvement of strapping was added in 1941 by Sayers.

621.385.16 : 621.384 **3813**

Preliminary Studies on the Design of a Microwave Linear Accelerator.—Halpern, Everhart, Rapuano & Slater. (*See* 3788.)

621.385.18.029.64 **3814**

Gas Discharge Switches for controlling Low Power Microwave Signals.—T-S.Ke & L. D. Smullin. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 698.) The keep-alive electrode in a t.r. switch was placed unusually near the r.f. gap. With this arrangement, "in a modified 1B24 filled with 12-mm nitrogen, 44-db attenuation was obtained when the keep-alive current was 0.4 mA." Summary of Amer. Phys. Soc. paper.

621.385.18.029.64 **3815**

Phenomenological Theory of the TR Switch Spike.—T. Holstein. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 698.) Summary of Amer. Phys. Soc. paper.

621.385.18.029.64 **3816**

The Band-Pass TR Switch : Part 1—The Switching Action.—M. D. Fiske. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 699.) The switch consists of a waveguide section with a number of uniformly spaced resonant breakdown gaps within it. With argon at a pressure of 10 mm Hg breakdown times of 5×10^{-9} sec are possible. Recovery time with pure argon is long (100 μsec) but may be reduced by a small addition of water vapour. Summary of Amer. Phys. Soc. paper.

621.385.18.029.64 **3817**

The Band-Pass TR Switch : Part 2—Linear Electrical Characteristics.—W. C. Caldwell. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 699.) By the combination of several resonant circuits in the waveguide, band-pass characteristics over a 12% wavelength range can be obtained. Summary of Amer. Phys. Soc. paper.

621.385.18.029.64 : 537.5 **3818**

Cross Sections for Capture of Electrons from TR-Tube Recovery Measurements.—C. G. Montgomery, F. L. McMillan, I. H. Dearnley & C. S. Pearsall. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 699.) Summary of Amer. Phys. Soc. paper.

621.385.18.029.64 : 537.525 **3819**

Low Pressure Gas Discharges in Microwave TR Tubes.—L. D. Smullin. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 698.) Summary of Amer. Phys. Soc. paper.

621.385.2 **3820**

Theory of the Diode.—J. K. Knipp. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 700.) The behaviour of the parallel plate diode for radio frequencies is discussed theoretically, taking account of space charge effects and of the distribution of velocity amongst the electrons. Summary of Amer. Phys. Soc. paper.

621.385.3 **3821**

The Application of Dimensional Analysis to Triode Valves at Very High Frequencies.—G. Lehmann. (*Onde élect.*, May 1946, Vol. 26, No. 230, pp. 175–187.) After a brief discussion of the advantages and the principles of the dimensional method, it is shown that the performance of similar valves depends only on the single parameter $\phi = Fd/\sqrt{V}$ where F = frequency, d = a linear dimension of the valve and V = a voltage of the system. The output, gain, voltage magnification, etc., of similar tubes can all be expressed in terms of ϕ, which is proportional to the transit angle of the electrons. For valves having the same type of cathode, the products F^3d and F^4V must be maintained constant for a constant output.

By simplified study of the movements of electrons in a valve in the class-B regime, it can be shown that the characteristics of a valve at low frequencies are conserved without material deterioration up to values of ϕ in the region of 2.5, where F is in Mc/s, d is the anode-cathode distance in cm, and V is the anode voltage in volts. Also, for this value, the Q of the output circuit will be about 18.

621.385.4.029.6 **3822**

Principles of Operation of the Resnatron.—F. W. Boggs. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 700.) A powerful u.h.f. tetrode oscillator with substantial transit time, unusual grid, and resonant cavities in the vacuum envelope. Summary of Amer. Phys. Soc. paper.

621.385.5 : 621.317.723 **3823**

A New Electrometer Valve.—J. A. Darbyshire. (*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, p. 277.) A double tetrode, in which each section has the characteristic of a single tetrode of type FP54, for use in a balanced bridge circuit. It has better grid insulation than earlier double-triode valves.

621.385.832 **3824**

Ion Burn in Cathode-Ray Tubes.—G. Liebmann. (*Electronic Engng*, Sept. 1946, Vol. 18, No. 223, pp. 289–290.) Experimental evidence that the ions responsible for fluorescent screen destruction are generated by the activation process of the cathode. Recent suggestions for the suppression of ion burn are outlined. See also a paper by C. H. Bachman (*Gen. elect. Rev.*, 1945, Vol. 48, p. 13) and 2403 of August (Liebmann).

621.396.611 : 621.385.1 **3825**

Modulation and Tuning of Cavity Oscillators by Electron Beams.—D. S. Saxon. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 700.) A theoretical study of tuning by passing the electron beam through an auxiliary cavity tightly coupled to the oscillator. Summary of Amer. Phys. Soc. paper.

621.396.615.17 : 621.317.755 **3826**

Time-Base Converter and Frequency-Divider.—P. Nagy & M. J. Goddard. (*Wireless Engr*, Oct. 1946, Vol. 23, No. 277, pp. 286–287.) A reply to criticisms of earlier papers. See 2093 of July (Moss) and back references.

621.396.645.014.332 **3827**

Peak Pulse Currents in Class B Amplifiers.—Sturley. (*See* 3563.)

MISCELLANEOUS

001.89 **3828**

Royal Society Empire Scientific Conference.—(*Nature, Lond.*, 27th July 1946, Vol. 158, No. 4004, pp. 136–141.) Report of discussions and recommendations on a number of subjects including the use of radar in map-making, cosmic-ray research, improvement in scientific information services, standards of measurement, and commonwealth co-operation in science.

5 + 6] : 778.53 **3829**

The Future of Scientific Films.—A. S. C. Lawrence. (*J. R. Soc. Arts*, 21st June 1946, Vol. 94, No. 4720, pp. 461–469.) Discussion of the requirements for satisfactory films, and their value for various purposes.

620.193 : 669.14 **3830**

Corrosion of Stainless Steel Sheet in Marine Atmospheres.—(*J. Franklin Inst.*, May 1946, Vol. 241, No. 5, pp. 372–373.) Short note only.

621.3.078 **3831**

Robot Dynamics — Theory of Non-Linear Automatic Control Systems.—M. Avramy. (*Phys. Rev.*, 1st/15th June 1946, Vol. 69, Nos. 11/12, p. 697.) Summary of Amer. Phys. Soc. paper.

621.317 **3832**

Scientific Instruments in Britain.—C. Darwin. (*Engineer, Lond.*, 26th July 1946, Vol. 182, No. 4724, pp. 78–79.) Lecture delivered at the Exhibition of British Scientific Instruments in Stockholm, describing the development and outstanding achievements of the industry during the present century, important war-time instruments, and the function of the (British) National Physical Laboratory.

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The Index to the Abstracts and References published throughout the year is in course of preparation and will, it is hoped, be available in February, price 2s. 8d. (including postage). As supplies will be limited our Publishers ask us to stress the need for early application of copies.

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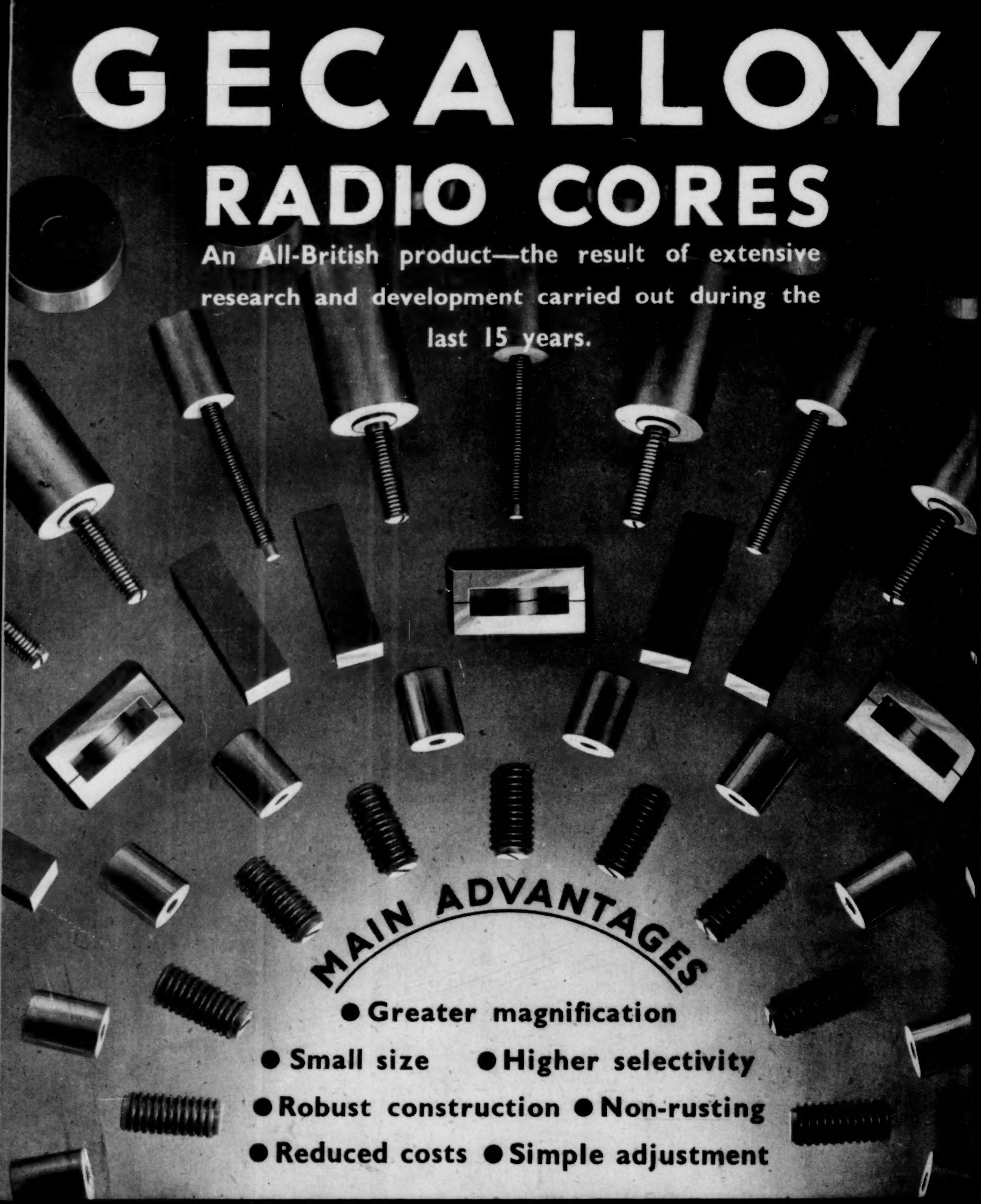

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